THE

SCIENTIFIC AND LITERARY REVIEW,

AND RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

Journal of the Inventors' Institute.

REGISTERED FOR TRANSMISSION ABROAD.]

[ALL RIGHTS RESERVED.

VOL. IX.—NO. 3.] [NEW SERIES.]

MARCH 1. 1874.

[PRICE 6d.

*** *Communications to the Editor to be addressed to him at* 21, *Cockspur Street.*

CONTENTS.

PAGE.
ADVERTISEMENTS ... 29
APPLICATIONS FOR LETTERS PATENT ... 29
SCIENCE AND THE GOVERNMENT ... 31
REVIEWS—
  Our Ironclads and Merchant Ships ... 32
  Jordan on the Ocean ... 32
  General Science ... 33
  Pink and Webster's Analytical Chemistry ... 33
  Pierce's Descriptive Geometry ... 34
  Reviews Postponed ... 35
PROGRESS OF TECHNICAL CHEMISTRY ... 35
NOVEL CONSTRUCTION OF MARINE WORKS ... 35
FIRE SUPPRESSION ... 36
SOLAR TRANSIT INSTRUMENT ... 36
PROCEEDINGS OF THE INVENTORS' INSTITUTE. 37
MONTHLY NOTICES ... 37
RAILWAY TRAIN COMMUNICATION ... 38
PHYSIOLOGY OF THE SIAMESE TWINS ... 39
THE LONDON AND PROVINCIAL BOILER INSURANCE COMPANY, LIMITED ... 39
PROCEEDINGS OF SOCIETIES—
  Royal Society ... 39
  Geographical Society ... 39
  Geological Society ... 39
  Chemical Society ... 39
  Microscopical Society ... 39
  Victoria (Philosophical) Institute ... 40
  Zoological Society of London ... 40
  The Institution of Civil Engineers ... 40
  Royal Institution ... 40
  Society of Biblical Archæology ... 40
  Anthropological Institute ... 40
KILN BUILDING ... 41
GADD'S STEAM GENERATING INVENTION ... 41
TO INVENTORS ... 41
CHEMICAL NOTES ... 41
EXHIBITION OF APPLIANCES FOR THE ECONOMICAL CONSUMPTION OF FUEL ... 41
APPLICATIONS FOR LETTERS PATENT ... 42

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

Chairman of the Council—**SIR ANTONIO BRADY.**

THE various efforts which have been made, and the numerous influences now at work to injure, if not to destroy, Patent Rights; the inefficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public; together with the proceedings so essentially involving the interests of inventors which have already taken place in Parliament, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organizing the influence of Inventors, Patentees and others. Its objects are:—

1st. To protect Inventors' interests and defend the privilege of obtaining her Majesty's Letters Patent.

2nd. To promote improvements in the Patent Laws.

3rd. To facilitate the diffusion of information with reference to Inventions and other subjects beneficial to Inventors and Patentees.

The qualification for Annual Members of the Institute is a yearly Subscription of One Guinea, and for Life Members a single payment of Ten Guineas.

Persons desirous of becoming members are requested to forward their names and addresses to the Secretary.

THE

INVENTORS' PATENT-RIGHT ASSOCIATION,

LIMITED,

21, Cockspur-street, Charing-cross, London, S.W.

Objects of the Association.

To obtain Patents for Inventions in this and other Countries at fixed and moderate charges.

To Register Designs.

To Sell and License Patented Inventions.

To form Public Companies, or otherwise arrange for the Public Introduction of Patented Inventions.

To furnish advice and Professional Assistance in developing Inventions.

To collect Evidence, arrange Arbitrations, and otherwise ssis tInventors in maintaining their rights.

A Handbook gratis on application to

THOMAS MORGAN,
Secretary.

Recently Published, price 2s.,

THE LAW OF PATENTS FOR INVENTIONS. By F. W. CAMPIN, of Gray's Inn, Barrister-at-Law.

London: LOCKWOOD, Stationers' Court.

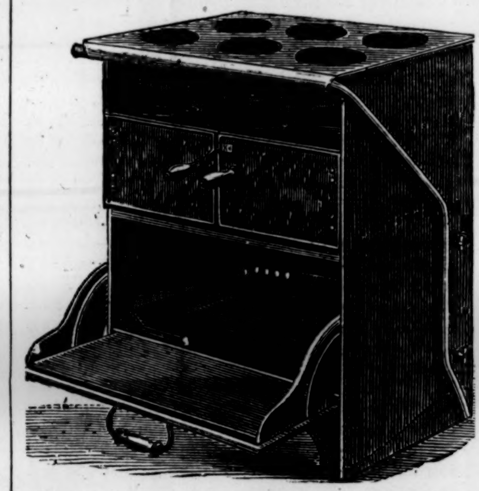
TO CAPITALISTS AND OTHERS.

BLAKE'S PATENT FIRE ALARM.—The SOLE LICENSE to WORK the above Patent is for DISPOSAL.

Terms: Royalty and small premium.

For particulars apply Inventors' Patent Right Association (Limited), 21, Cockspur-street, Charing-cross. For description see paper read before Inventors' Institute, published in the SCIENTIFIC AND LITERARY REVIEW, March 1st, 1874; "English Mechanic," July 18, 1873; "The Engineering and Building Times," July 14, 1873. For account of experiments at the Crystal Palace see "Standard," October 31st, 1873; "Court Journal," November 8th, 1873, &c.

THE
ECONOMIC GAS RANGE
AND
ROASTER COMPANY.



ON SOUTHBY'S PATENT,
WHICH SECURES
PERFECT VENTILATION,

A 7lb. Joint Roasted to Perfection for One Halfpenny.

Selected by the Commissioners for the International Exhibitions, 1871 *and* 1873.

A pennyworth of Gas, perfectly consumed and economised as it is under this Patent, does as much work as sixpenny-worth of Coal.

Positive immunity from every trace of smell or smoke is combined with perfect simplicity.

ROASTERS, from 10s. 6d. to £1 5s.

RANGES, £2, £3 10s., £6.

Estimates given for Fitting-up Hotels, Restaurants, and Large Establishments.

TO BE HAD OF ALL IRONMONGERS AND GASFITTERS.

WORKS—2, BASSETT STREET, MALDON ROAD, KENTISH TOWN, N.W.,

Where the Apparatus can be seen in operation; and at Mr. WOODCOCK'S Offices,

23, ABINGDON STREET, WESTMINSTER,

Where Mr. SOUTHBY can be consulted by appointment.

APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-street, Charing Cross.

On November 14th.—3701 to 3712.—A. Petremant. Ladies' dress improver com).—A. Browne. Joining the ends of leather straps or bands (com.)—G. E. Mewis. Fastenings for connecting sash cords to window sashes, which improvements are also applicable to the connecting of cords for other purposes—J. Imray. Clearing rollers for cards (com.)—B. Cooke. Apparatus for counting.—G. Weston. Grate or furnace bar applicable to the fires of steam engines, furnaces, brewing pans, and other similar purposes.—W. Davies. Hinges.—W. F. Baths and P. D. Hedderwick. Apparatus for excavating under water, and for raising and lowering materials in or out of the water.—J. Revell. Footsteps and bearings of spindles, bobbin wheels, or braids working in connection therewith, saddles of rollers, and apparatus and vessels for lubricating the same, parts of such apparatus and vessels being applicable to lubricating rollers, shafts, slides, or other bearings.—J. Smith. Umbrellas and parasols, and fastenings therefor.—J. H. Johnson. Printing machines (com.)—J. G. Tongue. Water or other fluid meters com .

On November 15th.—3713 to 3726.—J. Walker and E. Ragon. Form and construction of rails for railways and tramways, and fastening the same to sleepers or bearers.—L. Hornblower. Fire-proof buildings.—T. J. Barnard. Concentration and treatment of low class and unmerchantable ores and minerals.—J. G. Williams. Manufacture of iron and steel and articles therefrom.—B. Hunt. Processes for the extraction of iodine (com.)—I. G. Bass. Machinery for preparing peat as fuel.—J. Ashworth. Steam engines.—J. Rathbone. Safe coupling and uncoupling of railway carriages and waggons.—S. S. Lewis. Process and apparatus for hardening, tempering, and annealing steel and other metals.—T. K. Scrutton. Travelling hat boxes.—W. Holyoake and C. Brown. Clippers for clipping horses and other animals.—J. H. Johnson. Apparatus for propelling on rail and tramways and breaks for the same, parts of which improvements are applicable to the raising and lowering of cages in mine shafts (com.)—T. Barnby. Head or hair pins.—R. Speir. Treating sugar.

On November 17th.—3727 to 3733.—C. Turner. Machinery or apparatus for fleshing and frizing sheep and other skins and hides, and for striking out skivers and roans preparatory to dyeing and after dyeing.—A. Goodwin. Construction and method of laying down of tramways or railways for roads, and for repairing existing tramways.—T. Reynolds. Washing machines.—W. E. Wiley. Fastenings for shirt studs, sleeve links, solitaires, and other articles of jewellery and dress, which improvements are also applicable to pencil cases and lead boxes.—B. Hoffmark. Manufacture of gunpowder (com.)—G. Rydil'. Steam boilers, boiler furnaces, furnace grate ares, self-feeding apparatus, improved ash box, and arrangements in working the same, applicable for locomotives, marine and land boilers, also other furnaces, and for other purposes.—T. Fletcher. Gas heating apparatus for laboratory use.

On November 18th.—3734 to 3747.—L. Graham. Apparatus for economising fuel.—G. W. Smith. Apparatus for propelling vessels.—W. Darlow and H. Fairfax. Magneto appliances, and magneto-electric apparatus for curative and other purposes.—G. Haseltine. Machinery for finishing horse-shoe nails (com.)—H. Harrild. Printing machines (com.)—H. C. L. Mensing. Tailors' irons, and irons for laundry and other uses.—F. Ripley. Machinery for spinning and doubling fibres.—P. A. Muntz. Metallic tubes for locomotive, marine, and other steam boilers.—H. Y. D. Scott. Purification of sewage water.—J. Tatham. "Condenser carding engines."—J. H. Johnson. Manufacture of iron and steel, and apparatus connected therewith, which apparatus is applicable to the conducting of other metallurgical processes (com.)—J. H. Johnson. Controlling the draft, and disposing of the sparks in locomotive boilers (com.)—C. F. Parsons. Apparatus for forming and shaping metallic ends and covers for boxes and cases. W. Russell.—Ayrshire bonnets.

On November 19th.—3748 to 3765.—F. W. Webb. Locomotive engines.—J. H. Petty. Nose-bags for horses.—B. Britten. Manufacture of glass or vitreous material.—J. C. Martin. Paper pulp.—J. Holding and W. H. Nicholson. Whips.—C. I. Tousaint. Composite straps or driving bands and other articles, and the construction and adaptation of machinery to be employed in connection therewith.—E. Pettitt. Smelting or reducing furnaces, and the manufacture of iron.—J. L. Harley. Furnaces and apparatus connected therewith.—W. M. Scott. Breech-loading small arms.—C. M. Spence. Machines for making screws. (Complete specification.)—J. R. Maples. Tramway cars.—G. W. Cottingham. Machines for ironing clothes.—J. Harrisson. Preservation of food, and the construction and refrigeration of enclosed chambers to be used for this and other purposes.—Jn. Hyde, Jh. Hyde, and O. C. V. Aldis. Apparatus or electric alarm lamp for mining purposes.—H. P. Huntoon. Pipe tongs (com.) (Complete specification.)—B. J. B. Mills. Treating fibrous matter with preservative agents, and apparatus to be used therein, and the preparation of materials therefor (com.)—W. Smith. Looms for weaving.—C. Warren, R.E. Fire-grates or stoves.

On November 20th.—3766 to 3789.—S. Howarth, R. Howarth, and G. Howarth. Making of paper from the husks of grain, commonly called "shudes."—A. Smith. Treatment of wool, hair, feathers, and other similar animal matters, in order to obtain size and other useful products therefrom (partly com.)—A. J. Goulstone. Preservation of organic substances and certain preserving materials or compounds employed therein, which preserving materials are also applicable to the cure of scab, foot rot, and other cutaneous diseases in sheep and other animals. W. A. Lyttle. Preparation and use of wood for the construction of pavement.—J. Lendall. Construction of garden frames and lights, and greenhouses for preserving plants.—E. P. H. Vaughan. Preparation for the prevention or disintegration of solid deposits or incrustations in steam boilers (com.)—J. Edgerton, E. Hordley, and J. Newton. Mode of and apparatus for communicating between distant places.—C. Wardley. Machinery for washing fabrics.—G. M. Moore. Water fire bars, connecting bearers, and water bridges for steam and other boilers and furnaces, and connections and apparatus appertaining thereto.—J. H. Cohrs. Railway couplings.—J. Wall and E. J. Penn. Fettling for puddling furnaces.—E. C. T. Blake. Treating, steeping, and bleaching jute and like vegetable fibrous materials.—A. Hill and W. Hill. Umbrellas and parasols.—J. Walmsley. Self-stopping motion for warping or beaming machines. W. Hooper. Telegraph cables, and in covering telegraphic conductors.—W. White. Precipitation of sewage and other foul waters.—R. Kennett. Substance to be used instead of collodion and other emulsions for photographic purposes.—Rev. G. H. Forbes. Compounds designed for the manufacture of cements or artificial stone, capable also of being used as an artificial fuel.—T. R. Croger. Umbrellas and parasols.—J. T. Gibson. Earth closets or commodes.—L. Turner. Looms for weaving elastic fabrics.—T. Bennett. Piling iron.—T. Hyatt. Manufacture of artificial stones, also applicable to various other substances, such as soda and alum, and also to fibres.—J. Fletcher. Construction of spring mattresses, also applicable to producing electricity for other purposes.

On November 21st.—3790 to 3803.—C. W. Hunt. Arrangement and mode of operating rail or tramways, and the cars or waggons used thereon, and the machinery or apparatus for moving, unloading, and operating such cars or waggons in coal yards, docks, or places where the transfer of minerals or other substances over short distances is required (Complete specification.)—J. Twibill. Steam boilers, flues, water heaters, and apparatus connected therewith.—G. Nimmo. Furnaces for the prevention of smoke.—H. W. Spratt. Voting by ballot.—Jn. Thornton Jh. Thornton, and A. Thornton. Carding engines.—R. W. Kenyon. Taps or cocks.—J. C. Ramsden. Apparatus for generating steam, economizing fuel, and utilizing the gases arising from the combustion thereof.—J. H. Knight. Steam digger.—A. Crestadoro. Construction of domestic and other fire-grates.—W. A. Gilbee. Preparing ammonia from urine (com.)—H. Tasker. Portable steam engines and traction engines.—W. Moore. Manufacture of plated and gated ingots of iron and steel, and the moulds used for that purpose.—W. Whiteley. Machinery for roving and spinning fibrous substances.—H. P. Trueman. Apparatus for measuring liquids.

On November 22nd.—3804 to 3824.—R. G. Chipperfield. Fire-places.—W. Weldon. Treatment of compounds produced therein.—R. P. Tickle. Mounting and securing stereotype or other similar plates in printing machines.—W. Ross. Apparatus for supplying and regulating the quantity of water used in waterclosets and other cisterns or vessels.—J. W. Clayton. Manufacture of waterproof paper.—H. E. Smith and C. Fountain. Printing and printing machines.—W. Lutwyche. Stoves.—T. S. Malone. Combined seat and stool for use as a school or writing seat, as a music-stool, or as a child's chair, or for other similar purposes.—B. Anderson and J. Harrison. Steam engines.—W. Clarke. Construction of machinery for moulding and compressing artificial fuel and other substances.—A. V. Newton. Copying inks (com.)—F. Render. Apparatus for heating the feed-water of steam-engine boilers, and improving the vacuum condensers of such engines.—E. Apperly. Tooth brush.—R. Griffiths. Steam ships and screw propellers for the same.—H. W. Dee. Joints or hinges for cigar and other like cases or receptacles, also for pocket and other books and diaries.—M. Bromley. Lathes for turning and facing tyres, rings, and other analogous articles.—J. H. Johnson. Pneumatic actions for organs (com.) (Complete specification.)—A. Wood. Excavator or digger.—J. G. Hawkins. Manufacture of gas (Complete specification.)—G. A. Poole. Means of and apparatus for indicating the depth of water under vessels afloat, partly by mechanical means and partly by electricity.—H. Gardner. Shoes for horses and other animals requiring to be shod.

On November 24th.—3825 to 3837.—V. Marlin. Applying the down and plumage of birds of all kinds in the manufacture of spun or woven goods.—W. A. Lyttle. Effecting the consolidation of the dust or small fragments of coal or coke into masses suitable for fuel.—W. B. Head. Ventilation of drains, soil pipes, cesspools, and sewers, and the purification of sewage gas.—W. Mein. Steam governors.—L. E. A. Sicard. Producing vacuum in order to preserve meat, food, and other organic or animal substances.—A. Collingridge. Refining mineral and other lubricating oils.—J. Elwell. Cattle and sheep cribs and racks, pens for poultry, dogs, and other animals, horticultural houses and hot-bed frames, a part of which improvements is also applicable to the construction of hurdles and fences.—S. J. Mackie and C. A. Faure. Manufacturing explosive compounds into grain or granules.—B. Green. Storing and treating sewage.—E. T. Hughes. Bolt-cutting machinery (com.)—A. M. Clark. Festooned edging or trimming (com.)—T. D. Briggs and C. Mason. Tanned hides and skins, and the process of currying leather.—P. E. W. Bassée. Guns and gun carriages.

On November 25th.—3838 to 3848.—S. C. Lister. Preparing and combining waste silk.—S. Simmons. Ventilation of hats and similar coverings for the head.—C. D. Abel. Means and apparatus for working brakes on railway trains by fluid pressure (com.)—J. J. Sylvester. Apparatus for guiding in a straight or plain path tracing, cutting, or grinding tools, or work operated on by such tools.—F. Wirth. Apparatus for viewing or contemplating photographs (com.)—F. Wirth. Method of introducing burning gas into melting furnaces, and the apparatus employed therefor (com.)—A. McFarlane. Machinery to be used in making chairs, and part applicable in other operations in which contiguous parallel spindles have to rotate.—S. H. Hodges. Apparatus for shaping the soles of boots and shoes (com.)—W. C. Stiff. Machinery for drilling iron and steel.—J. A. Peer, E. Lundquist, and J. Rutherford. Concentrators, being applicable for separating substances of different specific gravities. (Complete specification.)—W. R. Lake. Gas engines and apparatus for producing gaseous mixtures to be used in the same (com.)

On November 26th.—3849 to 3870.—J. B. Thompson. Smokeless furnaces and stoves.—A. H. Robinson. Meters for measuring water or other fluids, parts of which are applicable to steam and hydraulic motive-power engines.—J. C. A. Henderson and M. Eley. Neck-ties or cravats, parts of which are applicable to other articles of wearing apparel.—A. Mackie. Type-composing machinery.—P. C. Macgregor. Treating, scouring, and dyeing woollen and worsted yarns, and apparatus therefor.—D. Tamet. Carriage for common roads (com.)—P. Jensen. Middlings purifiers (com.)—C. Williams. Mechanism or arrangements for the propulsion of vessels. (Complete specification.)—G. Goldsmith and J. Dilkes. Self-acting gates or sluices for preventing the overflow of water from rivers or water-courses.—W. Brown. Manufacture of reps, Turkey satin cloths, borderings for furniture, carriage linings, dress goods, and fringes.—N. W. Mitchell. Machine or method for sizing corks, or for separating and distributing the different sizes of corks or other articles requiring to be sorted into different sizes.—E. A. Ramsden and W. Dawes. Machinery or apparatus for indicating or registering the number of passengers travelling by public vehicles.—D. Semple. Violins.—M. Gray. Mode of maintaining the insulation of underground telegraphic wires.—M. Gray. Method of insulating and maintaining the insulation of underground telegraphic wires.—A. V. Newton. Manufacture of waterproof boots, shoes, and gaiters (com.)—A. Ford. Manufacture of asphaltes.—J. T. Palmer and R. Dixon. Manufacture of improved fuel from bark, tan, and other substances.—R. Harrington. Umbrellas and parasols.—J. F. Parker and A. Wade. Process and apparatus for the manufacture of coke and illuminating gas, part of which may also be applied to the smelting of iron ores and other ores.—P. A. W. Clarke and B. F. Donisthorpe. Padding or stuffing of upholstery, cushions, and various articles of dress.—I. B. Coldwell. Obtaining motive power.

On November 27th.—3871 to 3887.—C. A. H. Lindemann, M.D. Preservation of every kind of organic tissue by a discovery of a new antiseptic as powerful as innocuous.—R. J. Bedington and T. Greaver. Poles for windows, bedsteads, carriage windows, and other upolstering purposes where simultaneous action, either in drawing apart or drawing together the curtains or drapery, is desirable, and which are also applicable to single curtains.—E. Dearden. Constructing and arranging the winding apparatus used at collieries and mines, and for other similar purposes.—E. Leigh. Manufacture of artificial fuel.—W. T. E. Bookey. Machinery for excavating and raising materials, such as earth, peat, clay, bricks, and the like.—T. A. Brocklebank. Apparatus for connecting together or "coupling" carriages of railway or other trains.—A. Tooth. Treatment of beer, conferring perfect keeping qualities and prevention of sediment in bottle.—W. F. Smith and A.

(*Continued on Page 42.*)

Scientific and Literary Review,
AND RECORD OF PROGRESS IN
ARTS, INDUSTRY, AND MANUFACTURES,
INCORPORATING THE
JOURNAL OF THE INVENTORS' INSTITUTE.

MARCH 1, 1874.

SCIENCE AND THE GOVERNMENT.

Since the abdication of King Cole as ruler of the domains of Science and Art in Albertsland, a dubious kind of unstable rule has there ensued. The paramount authority—the British Government—under whom the whilom potentate exercised his sway, having, by experience of his proceedings, found the relative positions of their ostensibly superior and inferior powers to be in actuality of much the same kind as in the case of the Khedive of Egypt and the Sultan of Turkey—namely, the relation of an inferior who scarcely ever yields obedience to his superior; a state of things quite to the taste of the inferior, but not so pleasing to the superior, Potentate.

Such in reality having been the positions of the abdicated ruler and the British Government, no wonder is it that his abdication was joyfully hailed as a release from an anomalously unpleasant state of things, and the determination made to take such measures as to preclude for the future all chance of recurrence, and to specially guard against the Government being ever and anon at the behest of a person who ought to be under the control of its authority, compelled to provide funds for carrying out various schemes promoted by such person without previous authorisation. In other words, our Government determined to be no longer bound to undertake the "financing" without the governance of the South Kensington Establishment, which always promised very great things, yet accomplished things not so very great after all.

However, when the Government began to attempt the practical realisation of the contemplated measures it was found that the matter was one of no ordinary difficulty to cope with, for they possessed no knowledge or taste for Arts and Sciences. In fact they soon perceived they had got a white elephant amongst them, and could not tell what to do with it; hence the now existent dubiety as to the system Government ought to adopt as regards South Kensington, and the character of arrangements for effectuating it in the future.

But the late King is not dead; he has only abdicated, and watches with the solicitude of a loving parent over his offspring, ever ready to make his spirit felt in his old domains, if haply opportunity present. Now, this keeps our Government in constant dread of being brought by some Cole Redivivus into the same state of thraldom from which they have just escaped; hence the bright suggestion made to them that safety consisted in shunting the matter altogether was at once accepted with a feeling of relief, and the *modus operandi* transference of the science and art business to the trustees of the British Museum gladly acquiesced to.

This acquiescence, however, was a "reckoning without the host." The abdicated King is not the sort of man quietly to see the labour of his life brought to nothing, and has begun to agitate against the adoption of such a system, in opposition to which he has, it must be owned, a good case to offer, for the Trust Board of the British Museum, as it now exists, is a cumbrous conglomeration of Hereditary Privilege, as regards the Cotton, Harley, Soane, and other families; and of High Officiality, (the Lord Chancellor, the Prime Minister, and so forth), together with a number of members elected by them—a very ill-assorted body, bearing in mind the fact that the non-elected trustees do not attain their positions in consequence of any special aptitude for their work, and, therefore, cannot be expected to be good judges of the sort of persons they ought to associate with them in it, as what by the public will always be considered the active commissioners.

Having so good a case, the abdicated potentate has lost no time in carrying on his counterworking against the proposed scheme with all his old fire and energy, rousing into activity the semi-torpid people of the Adelphi, his great allies and friends throughout his whole career, and with their aid a counter system is now pressed forward, the great feature of which is that, seeing the principal objection to King Cole and his Art and Science plans was the large amount of money he called upon the Government to pay for them that this difficulty is to be removed by the proposed application of the annual surplus of the Patent Office to keeping up the South Kensington Department in an improved form, so as to include a brand new Patent Museum, with aids for technical instruction, and so forth.

In other words the money wrung from the poverty of Genius, as our patent taxes have been aptly termed, is to be applied to support the *dilletante* establishment at South Kensington, and a great public work in which the whole nation is deeply interested, namely, the establishment and maintenance of museums of art and science and technical education institutions, must be kept up by money paid as taxes only by inventors and patentees.

We have, as all our readers know, been ever ready to advocate the necessity of every possible aid being given to the promotion of technical education, but we do protest against inventors' money being applied to any than inventors' purposes; and we hold that the first claim upon the Patent Office Surplus is *reduction of the cost of obtaining and maintaining patents*, and the payment of a competent staff of scientific officials to do the work required at the Patent Office for enabling inventors to ensure validity and novelty in their patents.

By all means let us have a Government department of science and art, which could be established at the Council Office under the vice-president, or Education Minister, and let him, like the Secretary of State for India, have a board of consultation and guidance, composed not only of representatives of the Royal Society and College of Physicians and Surgeons, but of the Institution of Civil Engineers, Society of Engineers, Geological, Geographical, Botanical, Zoological, and other similar societies, and last, but not least, the Inventors' Institute, and although we shall even then object to the Patent funds paying all the cost of this scheme, we will cheerfully advocate that a handsome contribution be made to it (if any surplus funds remain, which, we firmly believe, will be the case) after the cost of patents has been reduced, and a proper system of granting patents be inaugurated at the Patent Office.

And, in conclusion, we may remark that, although what we have stated refers to the action of the late Government, we see no reason to believe that the views and relations of the new one will be very different in Art, Science, and Patent matters.

Reviews.

OUR IRONCLADS AND MERCHANT SHIPS.

"Admiral Fishbourne on our Ironclads and Merchant Ships." By Rear-Admiral E. GARDNER FISHBOURNE, C.B. London: E. and F. N. Spon, 40, Charing-cross. New York: 446, Broome-street. 1874.

PERHAPS there is no one better entitled to give an opinion in regard to the construction of ships than the author of this work, for he can speak with all the weight which attaches to the opinions of a man who combines practical experience and scientific knowledge.

That the construction of floating vessels is a matter of the very first importance to this country no one can doubt, and all those who have paid any attention to the progress of marine affairs must acknowledge that fancy and theory have had full swing in presenting us with schemes of improved construction of our sea-craft. The engineer and the ingenious mechanic, and even the journalist, have all in turn come forward to teach the shipwright and the mariner what is the kind of construction they should adopt and favour. Persons whose acquaintance with sea voyaging is limited to an occasional trip down the river in a steamer make propositions of constructive reform with the same confidence as if they had been for years practically engaged in building or handling ships.

Now, Admiral Fishbourne, as we have already intimated, is in a very different position to any of these persons adverted to, and his words are therefore entitled to favourable attention, more especially as their main intent is to shew what are the true principles of "stability" and safety at sea in floating vessels. After remarks on the diverse character and great variety of notions as to the proper construction of ships, commenting especially on the Froude-Reed system, Admiral Fishbourne says:—

All this inconsistency and looseness establishes the unreliableness of the current modes of calculation. Moreover, it is said that in action the ends of the *Inflexible*, which are unprotected by armour, are to be filled with water, and that "directly the water is allowed free access to the ends above the armoured deck, the only reserve of buoyancy is that afforded by the central citadel, but this will be assisted by a belt of cork, 9 or 10 feet in depth, resting on the armoured deck—a plan suggested by Sir Wm. Thomson."

That is, when by this increased immersion the ship is in greater danger of capsizing from being deficient in stability or from being run over by a ram, she is furnished with this cork to save her! The attempt is certainly due to her crew.

This *life*-belt will be efficacious in proportion to its volume, nearness to the water-line, and its horizontal distance from the centre of gravity, together with the smallness of its own specific gravity.

The principle is that which the writer has been for years contending for, and whether it be perceived or not, it is clearly an admission as to the correctness of views herein and long since enunciated by him, and likewise an admission as to the *incorrectness* of the received mode of calculating stabilities.

We are assured that the only hope of safety from numberless disasters, both in the Royal Navy and in the Merchant Service, lies in the adoption of the methods we propose in lieu of the dangerous assumptions we have exposed.

It may be asked, how it is that the system objected to has served for so many centuries? The answer is easy and complete. Owing to the heavy bottoms, and to the heavy weights being placed down in them, while buoyancy was preserved near the load water-line, there was a large margin of error on the *safe* side which was not seriously affected by smaller errors that occurred on the *unsafe* side.

When, in accord with the Froude-Reed destitute of stability system, ships were built upside-down, *i.e.*, with light bottoms and empty spaces in them, and with an accumulation of weight near the load water-line, the margin of error was moved to the *unsafe* side, and though these ships were only saved from capsizing by a reversal of the principle upon which they were designed, their designers will not be persuaded that their fatal disease was want of stability, but still contend that their scheme was good, because these ships possessed, equally with the French *Océan* class, a nominal stability represented by 2 feet of metacentric height, and the French ships were sailed and did not capsize, forgetting that their metacentric height was 2 feet margin on the safe side, = 2 = 2, or 3 feet, while that of the *Vanguard* class was 2 feet — the margin on the unsafe side = nothing or little!

The Admiralty Constructors say truly, that "their calculations do not enable them to determine what is the amount of *stability* which is necessary for a ship to render her *safe* as a sea-going sailing ship. We can merely compare the amount in one ship with another."

We have demonstrated that they cannot do even this latter, that their comparative estimates are radically wrong and dangerous; moreover, that the assumptions upon which their calculations are based, *i e.*, that a ship revolves round a point in the midship section at the water-line or round the centre of gravity, and that an equilibrating lever, or lever of stability, giving a correct estimate of the stability, is attainable by their system, are untrue and as little worthy of belief as is any other of the most untrue of popular superstitions.

For even were their premises true, they are not worked out with mathematical accuracy. But their premises are not true, inasmuch as they assume an axis and a point in this axis as the origin, a point which has never been determined, and that which they have assumed is not the true one.

Therefore, to continue to design ships on such an hypothesis, and to support colleges and schools to extend and give permanency to such views, is to hinder progress and to guarantee waste of life and treasure.

We have no desire to join in the controversy the Admiral enters into, but we are bound to state that his arguments appear to be thoroughly consonant with common sense, and in conformity with scientific teaching.

One remark, which bears upon the very important question that has been raised by Mr. Plimsoll, we cannot refrain from quoting, for it entirely accords with the plea for caution in dealing with the subject already stated in former pages of this journal.

If the legislation that may be recommended by the Royal Commission appointed to take evidence as to the condition and equipment of the vessels in the Mercantile Navy, shall be based on the supposition that the existing methods of determining the stabilities of ships is correct, very lamentable results will follow, for Parliamentary protection and warranty will be sometimes given to ships in a very dangerous condition.

In this work one point in discussion is so enchained with others, that quotation affords little knowledge of its true scope and effect; we therefore must remain content with the foregoing extracts, and conclude by stating that it investigates the Effect of Unequal Distribution of weight laterally, Defects of Ironclads, and the Stowage of Ships. And in an appendix, the Centre of Pressure, Geometrical Proposition, Determination of the Effects of an Unequal Distribution of Weight on the supposition that the Centre of Gravity is the Axis of Rotation, Rotary Motions and the Principal Axes of Rotation of a Solid body, Principal Axes of Rotation, and Methods of averaging Products.

JORDAN ON THE OCEAN.

"The Ocean: its Tides and Currents, and their Causes." By WILLIAM LEIGHTON JORDAN. London: Longmans, Green, and Co.

THIS is a very valuable addition to the list of works advancing our cosmical knowledge, being based on the author's "Treatise on the Action of Vis-Inertiæ in the Ocean," and published by him in 1868, in some measure a second edition of "The Elements, or an Investigation of the Forces which determine the position and movements of the Ocean and Atmosphere," published in 1866; the present work being also, to a great extent, a third edition of the same, revised and partly re-written; though in each the subject is treated in a different manner. In "Vis-Inertiæ" the question of the existence or non-existence of any action of that force in the ocean is treated as a question to be solved; whereas in this work the oblate spheroidal form of the earth is accepted as a sufficient demonstration of its action in the ocean and on the surface of the earth, leaving only the amount of that action to be ascertained.

In this work (says the author) I have abandoned the attempt to draw collateral evidence of the action of the forces described as circulating the waters of the ocean from the movements of the barometer; because I have not been able to give the requisite attention to the subject, and the more direct evidence given in this work appears to me sufficient.

In "Vis-Inertiæ" I think I have attributed too much influence to the eastward tendency of the tides in the temperate zones; and I did not notice the northward motion in the southern hemisphere, and southward in the northern, which results from the tides in the temperate zones being normally in advance of that in the equatorial regions.

A great part of "The Elements" has been but a scaffolding for the cosmogony enunciated in this work, and has served its purpose, for the general principles of the work, for the construction of which it has served will now stand without it, notwithstanding its many shortcomings in matters of detail. My inability to give undivided attention to the subject, or, I may say, the inability of my pen, under any circumstances, to do justice to the themes on which it has been employed, may delay, but will not ultimately prevent the triumph of the views which I have here endeavoured to make intelligible to the reader.

As the movements of the ocean and air are so intimately connected that arguments regarding the movements of the one involve, almost necessarily, a consideration of those of the other fluid, it is greatly to be regretted that it has become customary to use terms, in reference to the direction of ocean currents, in exactly the opposite sense to that in which the same terms are used in reference to the winds. This custom is so firmly established that, as the advantages to be gained by altering it are not perhaps sufficient to repay the temporary confusion consequent on a change in the use of terms, the idea of changing the custom cannot perhaps be entertained; though a judicious use of terms has more to do with the progress of any science than is perhaps generally supposed. In speaking of the wind, the terms used denote the direction from which the wind blows; whereas, in speaking of ocean currents, the terms used denote, not the direction from which the current runs, but that towards which it runs. Thus an easterly wind denotes a wind running from east to west, but in the ocean an easterly current denotes a current running from west to east. In order, in some measure, to obviate the confusion which this injudicious use of terms tends to cause, I have invariably used the termination "ward" instead of "ly" in reference to ocean currents, so that as an easterly wind denotes a wind running from the east, an eastward current denotes a current running towards the east. The ordinary use of these terms has been so confused, and their relative meanings so ill-defined, even by the best authorities, that the distinction which I have here made does not interfere with any previous definition of their relative significations.

To show the manner in which "The Elements" has served to evolve the views which are now more directly supported, I may point out that in that work I asserted, simply in consequence of purely abstract reasoning, that a tide must be raised by gravitation on that part of the earth's surface which is in advance in the earth's obital motion, and that a counter-tide must be raised by vis-inertiæ on the opposite side; and also, that a tide must be raised by the sun's gravitation on the side of the earth turned towards the sun, and an equal counter-tide raised on the opposite side by astral gravitation. Both these assertions are absolutely correct, and yet there are only two tides raised (apart, of course, from the lunar tides), instead of the four which the assertions at first sight appear to necessitate. For I have since ascertained, as shown in "Vis-Inertiæ" and in this work, that the force of gravitation which draws the earth onwards in its orbit is that of solar gravitation; and that the force of vis-inertiæ, which acts in the opposite direction to that of the motion of the earth, is the force of astral gravitation, which opposes that of solar gravitation.

The above, and some further prefatory observations which I think it well to offer, are not, however, likely to be clearly appreciated by the reader until after the perusal of the whole work. I think it expedient to say this, lest otherwise what may at first sight appear to be difficulties in the preface might deter some readers from perusing the body of the book, which I am sure no reader of ordinary intelligence will fail to understand.

Since the arguments adduced in the "Treatise on Vis-Inertiæ" have shown that gravitation is an effect of vis-inertiæ, it may here, in reference to the consideration of the forces which determine the configuration of the earth contained in "The Elements" (vol. ii. p. 48), be observed, that gravitation considered as a static force is vis-inertiæ; and that the centrifugal force acting from the axis of rotation is gravitation, and that this latter force of gravitation, as also that which draws the earth onwards in its orbit, is a dynamic force caused by vis-inertiæ in consequence of the action of the dynamic force there termed evanescence. This, however, in no manner interferes with the theory of the forces which determine the configuration of the earth as there described; for the centrifugal force, treated as resulting from the axial rotation of the earth, is gravitation, which is also the force which causes the onward motion of the earth. And these forces of gravitation are equally dynamic actions (and, in fact, inseparably concomitant actions) of vis-inertiæ caused by the action of the force termed evanescence. But, as there stated, the abstract nature of these forces was a question with which we were not then concerned. We were concerned only with the mere matter of fact, that where motion exists there exists some force to cause it; and that where axial rotation exists there exists a force giving the particles revolved in the motion of rotation a centrifugal tendency from the axis of rotation.

This is all with which Newton was really concerned in his demonstrations, as the abstract nature of this centrifugal force was unknown; but in endeavouring to account for it, he went out of his way, and erred in assuming the centrifugal force which opposes the centripetal force of solar gravitation, and holds the planets at their mean distances from the sun, to result from an innate tendency to move uniformly forwards in a straight line; and he doubly erred in assuming this asserted tendency to move uniformly forwards in a straight line to result from an innate force of vis-inertiæ, by virtue of which any body once set in motion tends to continue that motion uniformly forwards in a straight line until other forces from without stop it. For, firstly, I have shown that vis inertiæ opposes motion in everything, and that its own inherent property of vis inertiæ must tend to bring a body to rest, under any circumstances whatever, just as much, and in the same manner, as the action of any force from without. And, secondly, I have shown that, as regards the motion of the planets in their orbits, the centrifugal force which opposes the centripetal force of the bodies which compose the solar system one towards another, and all towards their common centre of gravity, is the force of astral gravitation opposing that of solar gravitation; so that, in their courses, they are borne smoothly along the lines of equilibrium lying between opposing forces of gravitation.

Besides the foregoing, I have shown that the revolving motion of the bodies which compose the solar system round their common centre of gravity would naturally result from the conflicting action of the forces of evanescence and vis-inertiæ, and must consequently continue, until either the motive force termed evanescence is exhausted by the constant resistance of the vis-inertiæ of matter, or until matter is itself exhausted by evanescence. We are not concerned with the question as to whether this latter is an appropriate term: we are simply concerned with the mere matter of fact, that certain forces are in play, causing constant change of form and place; and to the combined action of those forces (to which no name has hitherto been given) I have applied the term evanescence.

The reader will observe that the theory of counter-attraction, or astral gravitation, need not be considered to supplant the Newtonian theory of centripetal and centrifugal forces, but rather to define the nature of the latter force; showing that it is similar to the former: both being gravitation caused by vis-inertiæ, which is just as much the primary cause of the centripetal as of the centrifugal force.

The effects are matters of observation, so that the point at issue is as to how those effects are caused; and I maintain that vis-inertiæ holds the planets in equilibrium, the centrepetal force of the sun's gravitation being a part of the action of the planet's vis-inertiæ just as much as the centrifugal force. The error lies in the cause to which the tangental effort is attributed; and I have endeavoured to show that that effort is not caused by the vis-inertiæ of the planet tending to carry it onwards along the tangent, but by astral gravitation (a part of the action of vis-inertiæ) retarding it, and tending to draw it backwards farther and farther from the successive positions to which the revolving force carries it along its orbit.

Vis-inertiæ is the combined action on universal gravitation, which actually does keep the planet on the line of its orbit; opposing any tendency from, as much as towards, the sun.

After careful investigation of this very elaborate treatise, we find nothing we can do which will render better justice to the author or our readers than the reproduction of the above statements, with the declaration of our own approbation of the work.

GENERAL SCIENCE.

"Introduction to Quaternions." By Profs. Kelland and Tait. (Macmillan and Co.)

"Physical Geography." By John Young, M.D. (Collins, Sons and Co.)

"Elementary Inorganic Chemistry; the Non-Metallic Elements." By Raphael Meldola. (Murby.)

"A Manual of Inorganic Chemistry; the Non-Metals." By T. E. Thorpe, Ph. D. (Collins, Sons and Co.)

"Inorganic Chemistry." By Dr. W. B. Kemshead. (Collins, Sons and Co.)

The above works are science school books by authors of more or less eminence in the world of science. We are not in a position to say more about them than that they will be found very useful.

"Animal Locomotion; or, Walking, Swimming; and Flying." By J. Bell Pettigrew, M.D. (H. S. King and Co.) Anyone who takes an interest in animal physiology will find this work worth perusal. One noteworthy topic is the action of the wing in the flying animal which Dr. Pettigrew claims (adversely to the counter-claims of M. Marey) to have discovered to be "that the wing describes a figure-of-8 track in space when the flying animal is artificially fixed."

"Man and Apes." By St. George Mivart. (Hardwicke.) As the production of a man of eminence, we notice this work, naming the title of which will afford a notion of its contents.

"Outlines of Natural Philosophy." By Bentham Simpson. (Collins, Sons and Co.) These "Outlines" are not very elementary, although stated to be "adapted for upper classes in elementary and middle-class schools;" in fact, it is like many more works new issuing from the press, that proceed upon the false assumption that the mere children who are the pupils at such schools are ready to study all sorts of to them recondite branches of knowledge; whereas they can, with difficulty, be brought up to a respectable standard in the three R's.

PINK AND WEBSTER'S ANALYTICAL CHEMISTRY.

"A Course of Analytical Chemistry (Qualitative and Quantitative)," to which is prefixed a brief treatise upon Modern Chemical Nomenclature and Notation. By WILLIAM W. PINK, Practical Chemist and Metallurgical Analyst; and GEORGE E. WEBSTER, Lecturer on Metallurgy and the Applied Sciences, Nottingham. London: Lockwood and Co., 7, Stationers' Hall-court, Ludgate-hill. 1874.

THIS, like most of the treatises in Weale's Series—of which it forms a part—is a very valuable text-book, equally available for the junior and the advanced student, and not without value as a concise book of reference to the professional practitioner.

The authors of this treatise state that they have endeavoured to arrange the Tables of Separation on as simple and efficient a method as possible, in order to prevent the confusion occasioned by many works on this subject.

The reactions of the bases and acids have been selected as those on which the greatest reliance may be placed.

In order that this work may be studied indiscriminately by all who have a knowledge of chemistry (old as well as present students), a brief treatise upon modern chemical nomenclature and notation has been prefixed; the old names of the different compounds have also been placed in parentheses after the new ones. As a sample of the character of the contents of the work, we present our readers with the following extract:—

In going through an analysis of a substance it has to be proved not only that certain elements are present, but that all the other elements are absent; for this reason we cannot adopt the method of indiscriminately adding reagents or tests to the mixture, but must go through a complete course of rules as laid down in this work; that is, it requires not only that the reagents be added in a certain order, but that the substances (sought for) be separated by the group reagents into families or divisions, and afterwards each group divided and subdivided, until the absence or presence of every element is satisfactorily proved by the resulting phenomena. The separation into groups is effected by reason of the same or similar change being common to two or more elements, these elements would then be said to belong to the same group or division. The student should always, on adding any reagent, pause and consider why such a substance is applied, and what is the chemical or physical change he expects, and what might prevent its appearance. The analyst is, in fact, a judge before whom all the circumstances are laid bare, and on whose judgment depends the decision; he must also remember that hardly any amount of reading or lecture-hearing can produce a practical analyst, as only practice can make perfect, and therefore the student is strongly recommended to make the experiments himself.

The first step is to make a preliminary examinatian of the substance, and every reaction should be carefully noted down, although the student may not find any direct reference to it in the tables. Mixtures may interfere, and sometimes entirely prevent some of the changes described under the preliminary examination, but it should always precede the systematic. The wet way examination, performed with care, indicates most, if not all, the elements present. Before proceeding to the wet way examination the student should try the solubility of the substance. By studying the table of solubilities much information can be obtained with regard to the elements present; thus, all the salts of sodium are soluble in water; if, therefore, we have nothing soluble in water, sodium is absent; or upon adding water a ppt. is formed, bismuth is indicated. If we require to fuse the substance, we know that (SiO_2), silicic anhydride is present.

The first table is then gone through, each division being laid on one side as finished, until the whole have been completed, after which the divisions A, B, and C are commenced, and the individual elements distinguished; it will at first be desirable that the student should thoroughly study the first table, so that, on a substance being given him, he can at once tell to which group or groups the component elements belong, When he can perform this expeditiously, he may proceed to the separation of the various members of the several groups, and, in fact, undertake the complete course of qualitative analysis.

As it is often necessary to ignite and fuse substances, the following facts must be attended to. Platinum crucibles or capsules are generally employed to ignite substances in, because of their infusibility, pliability, and the resistance they offer generally to the action of many powerful elements when in a nascent condition (that is, just liberated).

There are, however, many operations in which these expensive utensils might be injured, or even totally destroyed, and therefore attention to the following directions (given by Berzelius) should be attended to, namely :—

In the dry way :

Never melt in a platinum crucible,

1. Caustic alkalies or alkaline nitrates; consequently,

No saltpetre (NO_2Ko) caustic potash (KHo), or soda ($CONao_2$). Because in such a case, protoxide of platinum would be formed, of course at the expense of the platinum. The protoxide of platinum dissolves in the alkali, and gives it a green colour.

2. No alkaline sulphurets;

Nor sulphates mixed with charcoal powder;

Because alkaline sulphurets act upon platinum with still greater energy than caustic alkalies.

3. No metallic substances;

Nor any mixture which may yield a metallic residue. Gold, silver, and copper may, however, be heated red hot in platinum crucibles without risk, provided the heat be not too near the point at which those metals fuse; but melted lead cannot be poured, even in a cold platinum crucible, without spoiling it.

A drop of lead, tin, or bismuth falling upon a red hot platinum vessel invariably makes a hole in it.

4. No phosphorus or phosphoric acid, mixed with combustible substances; because they would form phosphuret of platinum, in consequence of which the platinum would be melted at that point, or would become shrivelled up.

5. Certain metallic oxides must not be heated to a white heat in platinum vessels;

Because it often happens that at such temperatures they part with their oxygen, in consequence of which their oxygen, whilst escaping, leaves the metal in a nascent condition, and then combines with the platinum as an alloy. The metallic oxides, which have the most tendency to become thus reduced, are the oxides of lead, tin, bismuth, copper, and nickel. If, however, the heat be moderate, they undergo no change.

6. Platinum combines easily with silica and carbon, so that the contact of platinum crucibles with charcoal, at a very high temperature, must be avoided.

In the wet way :—

Platinum must never be used with substances capable of disengaging chlorine; wherefore, *Aqua Regia*, even very dilute, must not be put in platinum crucibles;

Nor must any substance containing manganese lie dissolved with hydrochloric acid (HCl), because chlorine would be evolved, which will act upon the platinum.

When, for example, the mineral substance to be analysed and calcined with an alkaline carbonate is green or black, it ought to be mixed with hydrochloric acid in a glass vessel, and evaporated until all odours of chlorine has disappeared. In general, all those substances may be boiled or evaporated in platinum crucibles, which do not contain either chlorine or bromine.

In filtering, the great requirement is rapidity, and to effect this, it is best to have the operation performed in an atmosphere of steam; to accomplish this the filtering should be conducted over a vessel of hot water, so that the steam may always be present.

How the details of analysis are set forth the following will show :

REACTIONS OF THE PRINCIPAL ACIDS.

The acids may be classified as follows :—

Group 1, Sub-Division 1, consists of those acids which are precipitated by SH_2, hydrosulphuric acid (sulphuretted hydrogen), from acid solutions, as sulphides.

$ASHo_3$, $ASOH_3$.—Arsenious and Arsenic Acids.

105. See Reactions Nos. 40 and 41.

Sub-Division, No. 2, precipitated as in Division No. 1, only as the oxide instead of the sulphide.

CrO_2Ho_2.—Chromic Acid.

106. NO_2Ago, argentic nitrate (nitrate of silver), gives a purple-coloured ppt. of CRO_2Ago_2, argentic chromate (chromate of silver).

107. $\left\{\begin{matrix}C\,(Me)O,\\ Pbo'',\\ C\,(Me)O,\end{matrix}\right.$ plumbic acetate (acetate of lead), gives a nice yellow ppt. of CrO_2Pbo'', plumbic chromate (chromate of lead), insoluble in weak acids.

This refers to Quantitative Analysis, whilst the following relates to Qualitative Analysis :—

TESTING THE BALANCE AND WEIGHING.

In Quantitative Analysis it is of the first moment that the balance should be correct to the least amount. A good and practically useful balance should turn very distinctly with a weight of 1 milligramme, or 0·0154 grain. If there is any little variation in the weights required for either scales to weigh a certain quantity, it must be regulated by means of small pieces of tinfoil (not paper, as that will absorb moisture).

The following experiments should be made to test the scales:—

1st. Load both scales with the greatest load they are constructed to carry, the balance then carefully adjusted, and a milligramme added to one scale-pan. This ought to turn the beam to the same extent as if the scales were empty. In most cases, however, it will show somewhat less on the index.

2nd. When both scales are loaded and in equilibrium, the weights are changed, so as to transfer that of the right scale to the left, and *vice versâ*. If the balance is true, and has perfectly equal arms, this will not affect its stability.

3rd. When a balance is disturbed from a state of rest, and made to oscillate, it should always return to its original position and equilibrium.

The balance must stand all these tests, though the least important is a slight variation in the length of the arms, as it does not interfere with the accuracy of the weighing. To keep the edges of the balance free from rust, it is a very good practice to place inside the case a beaker half-filled with sulphuric acid, SO_2Ho_2, or $BaCl_2$, baric chloride, The balance should not be kept in the laboratory.

In weighing, any small variation in the lengths of the arms of the balance will not interfere with the correct results, because, as a rule, we have always one scale-pan for the weights and another for the substance to be weighed; but of course any perceptible error must not be allowed to pass.

The following considerations must be attended to :—

1st. If the substance to be weighed is liable to attract moisture, it should be weighed in a closed vessel, or between two watch-glasses.

2nd. No substance should be weighed whilst hot, as the ascending currents of air caused by the heat of the body under examination will cause the apparent weight to vary every instant.

3rd. In weighing, the weights should be added with care and judgment, not placing a great weight on at first at a venture.

4th. The same plan as is recommended for the qualitative examination of a substance should also be strictly carried out in weighing and all operations connected with the quantitative analysis of a substance—viz., that every operation and step should be carefully noted down in a note-book. The weight of the vessel should be entered, together with the substance weighed, and then the weight of the vessel subtracted, to leave the real weight of the substance.

PIERCE'S DESCRIPTIVE GEOMETRY.

Treatise on "Practical, Solid, or Descriptive Geometry." Embracing Orthographic Projection or Radial Projection. By W. TIMBRELL PIERCE, Architect, late lecturer on Geometrical Drawing at King's College (vice Professor Bradley) and Harrow School. London: Longmans, Green, and Co. 1873.

WE certainly agree with the author of this work in thinking that it will supply a want which has long been felt. It is true, we have innumerable works relating to this branch of study, but the smaller works are mainly too meagre to be styled text books, and in such as treat the subject of solid geometry more fully, we have generally found (as in the case of Professor Bradley's well-known work) that although the illustrations of the various problems are all that can be desired, yet the descriptions of them are usually far too short of what is required to enable pupils, with the ordinary standard of intelligence, to understand or work out the problems. Therefore, we consider students are indebted to the author of this admirable volume for supplying the want of a good text book for English students; and here we have to remark that the Continental nations of Europe are far before us in this branch of study, for with us in England it is, or has been up to a very recent period, almost a matter of speculation as to what solid geometry really is, whilst in the case of our Continental neighbours in nearly every polytechnical school it is a compulsory branch of study, and this is, we assume, the reason why so many and such excellent works on the subject exist in foreign languages. However, we may confidently expect, now that technical education is becoming a question for immediate settlement, that in the future only the works which will enable the different sciences of practical application to be grasped, will obtain the status of text books, and that these will be of such a character as will compensate for the backwardness which has characterised us up to the present time. Certainly the work under notice is the best of its kind that we have perused, and we cordially recommend it to all interested in the study of solid geometry.

REVIEWS POSTPONED.

"Elements of Chemistry." Fifth edition. By the late W. H. Miller, M.D., LL.D. Revised by Herbert McLeod, F.C.S. Longman and Co.

"Introduction to the Study of Organic Chemistry." By H. E. Armstrong, Ph. D., F.C.S. Longman and Co.

"Polar World." By Dr. Hartwig. Longman and Co.

"The Moon." By James Nasmyth, C.E., and James Carpenter, F.R.A.S. John Murray, Albemarle street.

"Dictionary of Languages." London: Messrs. Hall and Co.

PROGRESS OF TECHNICAL CHEMISTRY.

Amongst proofs of progress in the above department of applied science is the production of the Salts of Potassa. It was long ago foretold by Chemists that the Salts of Potassa would be obtained directly from the mineral kingdom, instead of indirectly through the ashes of terrestrial vegetation, but the prophecy was not fulfilled until 1861, when the commercial production of Potash fertilizers and Chloride of Potassium began at Stassfurt mine. The following year the mine of Leopoldshall, in the Duchy of Anhalt, was opened. The deposit at these places consists of beds of common salt, interstratified with small beds of Carnalite, the hydrated double Chloride of Potassium and of Magnesium, and Kieserite, the hydrated sulphate of Magnesia.

Beside these are found Kainite, the hydrated double-sulphate of Potassa and Magnesia, Chloride of magnesium, and Sylvine, the chloride of Potassium, the latter merely in pockets. Existing distributed throughout the deposit are Boracite, acid Borate of Magnesia, Chloride of Magnesium, Tachhydrite the hydrated double chloride of Calcium and Magnesium; Anhydrite, the anhydrous sulphate of Lime, and Antracanite, the hydrated double sulphate of Soda and Magnesia Carnalite Kainite and Tachhydrite contain small quantities of bromides. In 1867 the yield of Potassa Salts in the mines was 3,350,000 centners, number of laboratories 16; in 1872, the yield had risen to 10,234,000 centners, and the numbers of laboratories had increased to 33. Eleven hundred miners and three thousand labourers were employed, and the population, only two thousand seven hundred in 1861, had become twelve thousand.

Regeneration of Manganese is another of the results of the inventive talent of chemists. As is also the production of Kerosene from Lignite. The first attempt made in Germany to distil off the oleaginous products of Bituminous coal resulted in failure, but more recently a sufficient measure of success has been realized to drive the products of American Pretroleum out of the markets of the little State of Saxe, and also out of those of the Kingdom of Saxony and of a portion of Austria. This success is ascribed to the employment of one variety of coal only, the Lignite, and the adaptation of the process to that variety, instead of, as fomerly, endeavouring to distil Kerosene from all varieties including Bituminous schist, boghead, &c., in similar apparatus. Indeed it would seem that but few of the Lignites prove profitable, and these from quite restricted localities. The product may be estimated at 100,000 centners of Paraffine, 300,000 centners of Kerosene, and 90,000 centners of second quality Paraffine. The latter is used in the manufacture of lubricating oils and illuminating gas, and is mixed with wax and stearine in candle making. For the same purpose the first quality of Paraffine is used without admixture. It is also employed instead of butter in the beet sugar process, and instead of wax in the making of children's dolls, and the impregnation of the wood of matches.

Artificial Madder Dye also evidences the important advances making in technical chemistry. Madder, the colouring matter extracted from the plant of that name, the *Rubia tinctoria* of botanists, is largely produced in Germany and France, and an idea of the total value of the product may perhaps be found in the fact that in the French canton of Vaucluse alone, madder yields annually from 7 to 8 millions of thalers. The colour of the extract is due to Alizarine, which can be obtained from it in red silky crystals, and this substance two German chemists, Graebe and Liebermann, were able to convert into Anthracene, a hydrocarbon derived from gas tar. Before the year 1868, in which they made this discovery had expired, they were able to reverse the experiment and convert Anthracene into Alizarine. They thus became the founders of a new industry, the manufacture of artificial Alizarine, which, since 1870, has so extended itself, that there are from ten to twelve manufactories in Germany, and parties in England and France have begun the business. In 1872, the yield was 22,000 centners of artificial Alizarine paste, valued at four millions of thalers. Gas tar contains about 5 per cent. of Anthracene, and is sufficiently abundant to furnish all the Alizarine demanded by the dye works. Although the natural madder red still competes with the artificial, yet the competition cannot last long, and it is probable that in two or three years the cultivation of madder will cease.—From the *Polytechnic (American) Bulletin*.

NOVEL CONSTRUCTION OF MARINE WORKS.

At the Institution of Civil Engineers, on Tuesday, February 10th, 1874, the following paper was read "On the Construction of Harbour and Marine Works with Artificial Blocks of Large Size," by Mr. Bindon Blood Stoney, M.A., M. Inst. C.E. The author described a new method of submarine construction, with blocks of masonry or concrete far exceeding in bulk anything hitherto attempted. The blocks were built in the open air on a quay or wharf, and after two or three months' consolidation, they were lifted by a powerful pair of shear legs, erected on an iron barge or pontoon. When afloat, the blocks were conveyed to their destination in the foundations of a quay wall, breakwater, or similar structure, where each block occupied several feet in length of the permanent work, and reached from the bottom to a little above low-water level. The superstructure was afterwards built on the top of the blocks in the usual manner by tidal work. By this method the expenses of cofferdams, pumping, staging, and similar temporary works were avoided, and economy and rapidity of execution were gained, as well as massiveness of construction, so essential for works exposed to the violence of the sea. There was now being built in this manner an extension, nearly 43 feet in height, of the North Wall Quay in the Port of Dublin. Each of the blocks which composed the lower part of the wall was 27 feet high, 21 feet 4 inches wide at the base, 12 feet long in the direction of the wall, and weighed 350 tons. The foundation for the blocks was excavated and levelled by means of a diving-bell, the chamber of which was 20 feet square, and 6½ feet high. When the men were at work the bell rested on the bottom. A tube or funnel of plate iron, 3 feet in diameter, rose from the centre of the roof of the bell to several feet above high-water level. An air-lock in the top of this funnel afforded a passage up or down, without the bell having to be lifted out of the water. The material excavated was cast into two large trays, suspended by chains from the roof of the bell; when these were filled, the bell was lifted a few feet off the bottom, and the bell-barge was drawn a short distance away from the line of the wall where the stuff was discharged, by tilting the trays, and the bell returned to its work again. The hull of the floating shears was rectangular in cross section, 48 feet wide, and 130 feet long. The aft end formed a tank, into which water was pumped to balance the weight of the block suspended from the shears at the bow of the vessel. The shear legs were rectangular tubular pillars of plate and angle iron, with a cross girder resting on the top; above this girder there were two sets of pulleys, through which were reeved the lifting (pitch) chains, formed of one and two flat links alternately. There were eight parts to each chain, or sixteen parts altogether, so that each part had to support. theoretically, one-sixteenth of the suspended block. The inner ends of the chains passed down to the deck, where they were controlled by a pair of powerful crab winches driven by a 14 H.P. steam-engine, which also worked a centrifugal pump for filling or emptying the tank. The slack of the chains, after passing through the crab winches, was led under the deck, and was coiled up in the engine room over fixed pulleys by two donkey engines. When paying out chain the donkey engines were thrown out of gear, and the crab winches on deck hauled up the slack according as it was wanted. Two cast-iron girders were built into the bottom of each block, and at the end of each girder there was a rectangular hole. Four vertical tubes were built in the block over these holes in the girders, and the suspending bars were lowered from above and turned at right angles, so that their ends, which were T shaped, caught beneath the girders. The upper ends of the suspender bars were also T shaped, and were attached in a similar manner to the lower sets of pulleys through which the lifting chains were reeved. When a block was set in place, the suspender bars were turned back 90°, and withdrawn for further use. Each block had vertical grooves left in the sides, and when two blocks were in place these grooves formed a tube 3 feet square. A mass of concrete was subsequently thrown into the grooves, to act as a key or dowel between block and block; this completely plugged up the joints, which were only about ½-inch open on the face.

The paper also contained a description of an annular block of concrete 19 feet in diameter, weighing 80 tons, which the author constructed for the base of a beacon tower, in the year 1863, and conveyed two miles down the Liffey, where it formed its own coffer-dam in water 5½ feet deep at low spring-tides. The water was pumped out by hand pumps, and the ground inside excavated, concrete being placed on the top of the ring as it sank, like the brick wells in India, or the shafts of the Thames Tunnel.

The method of making concrete and mortar, adopted by the author, differed in some respects from that in ordinary use. He preferred a rapid mixture of the ballast or sand with cement or lime to the slow triturating process of the mortar pan with edge runners. The concrete mixer, devised by him, driven by a 3 H.P. engine, would turn out from 10 to 12 cubic yards per hour. The mixer was a fixed horizontal or inclined trough, open on the top, with a longitudinal axis, having stout iron blades at short intervals, which, as they revolved simultaneously, plugged the materials and screwed them forward. The water was let on gradually through a rose, and the first few blades incorporated the materials in a dry state before they reached the water.

The author believed the application of the new system of gigantic blocks to the construction of breakwaters, would, in many cases, be cheaper, more rapid and more permanent than the ordinary methods of construction.

FIRE SUPPRESSION.

THE following is the principal portion of the paper readat the Inventors' Institute, 19th February, 1874, by Mr. P. A. Blake :—

When you tell a person there are over two thousand fires annually in the metropolis, they say "Dear me!" give a sigh, and then go on to some other snbject, as if you had told them there were so many thousand deaths, and it was a very sad thing; but there is no help for it. But the two thousand fires are an evil that may be prevented, and means ought to be taken to do so. To think that every year, in this city alone, some score of persons are burnt to death in their beds, let alone the destruction of several millions worth of property, calls out for something to be done. The money panic in America is attributed by some, and not improbably, to the damage done by fire at Chicago and Boston.

[Mr. Blake added further remarks on the importance of the subject, and the necessity of measures being taken to diminish the number of fires. These, for want of space, we are compelled to dispense with.] He then proceeded : Hitherto nearly all the energy devoted to the subject has been wasted in trying to devise means to put out large conflagrations ; now, I maintain, this is an unnecessary and hopeless problem. The practical problem is "to devise an apparatus which must be economical in every respect, to give timely warning of the outbreak of fire.

The following method struck me as simple, reliable, and exceedingly economical:—Quick burning fuses are led from the various parts of the building to a bell alarum, or, what I think far better, two or more maroons, as they are sure to be heard without being necessarily placed near the sleeper's apartments. The fuse is generally passed round the room near the ceiling—it is unobservable, being dyed to match the paper or ceiling ; in this room the fuse would be passed round near the ceiling and also beneath the balcony—(here is a short length passed along here ; you observe it is scarcely to be seen); it is then carried through the wall and connected with a main fuse. Fuses from other rooms and parts of the building are also connected with this main fuse, which finally leads to the maroons placed in any convenient spot.

The junctions between the branch fuses and the main fuses are such that the fuse burns straight to the maroons, without setting alight to the branch fuses or digressing at all from its path. Here I have one of such junctions possessing the required property of transmitting the fire in one direction only. I apply a light to this end, and the fire passes on and ignites the other. I take another junction and ignite the opposite end, and this time the other end is left unignited. Here is a specimen of a fuse we find best for the purpose ; it travels about 100ft. per minute ; here is some cased fuse which travels 400ft. or 500ft. per minute.

Supposing this room to be fitted as I describe, which would cost about £5, it is obvious to you a fire could attain but a very small magnitude prior to setting alight to some part of the fuse ; a few seconds after the fuse had caught the alarm would be given, and I think I may safely state, from the many like experiments we have made, an eighteenpenny squirt would suffice to subdue the flames.

The following practical test of the efficiency of the alarm we have tried many times :—

Wood was purposely so built up in the coach-house of a stable as to fire the building if we did not succeed in subduing the flames in time; it fairly represented any wooden structure as far as our purpose is concerned, reaching from the ground to the ceiling. The lower part of the stable was fitted up with the fire-alarm I have described; some straw was now put against the wood and set on fire. The result was as I have before explained—the flames could never get beyond a certain magnitude before off went the fuse, and the alarm was speedily given. We have waited from two to five minutes, or more, after hearing the alarm before pumping on the flames, and yet have always succeeded in subduing them with about a pint of water.

I fail to see that these fires we have extinguished in the stables I spoke of are different to the commencement of other conflagrations—the timber was dry, and purposely piled up for burning, and hence I see no reason why nearly all conflagrations should not be put out as easy, if buildings were only provided with a suitable fire alarm. With regard to how soon these fuses ignite, they require a temperature of about 300° Fh., or less than half as that again as boiling water; so in cases were the fire is caused from the overheating of flues, &c., the alarm would be given before there was actual fire, as the fuse is laid wherever danger is apprehended, such as the spot where a flue passes dangerously near some woodwork. Well, then, fires originating from the overheating of surfaces would be detected, or rather the alarm would be given before the place was really on fire. Those that originate from a light thrown down, &c., it is obvious could not be detected before there was any flame, as it originates from a small flame, (and yet I have been told my alarm ought to do this), but as soon as a current of gas heated to 300° comes in contact with the fuse, off it goes—it is not necessary for the flame to touch, as I will show you. I hold a lamp some distance under this fuse, and the heat suffices to ignite it. I have made it ring a bell instead of firing these maroons, as the latter noise would make your ears ring rather unpleasantly. These maroons would do no other damage. I have fired the larger size you see here suspended by a piece of string from my hand. If placed in the midst of paper, they will blow it to pieces without even scorching it.

"A fine idea," says somebody, "to have fuses, maroons, and I know not what placed all over your house. Thank you, I would rather be without your fire-alarm; the house might certainly then go off like a firework—full of fuses and maroons; it stikes me the cure would be worse than the disease."

As this idea is likely to enter the minds of all, more or less, upon the subject being brought before them for the first time, let us see what foundation there is for this supposed danger.

First, with regard to the cure being worse than the disease, considering the disease (viz., part of the building or its contents on fire, and nobody aware of the fact—perhaps all fast asleep) is generally death to the building, and sometimes to its inhabitants. I don't think the cure could very well be worse than that; however, let us see what damage the cure could do. As to the maroons, I have already stated they will not set anything on fire, and as a proof of harmlessness, have fired them only two feet from my own person, and so a broken window pane would be the worst to fear from these. Now as to the fuse. If there were any danger of it setting things alight, we can so hang it as not to give it the chance of doing so; besides it is only the short length between the seat of the fire and the maroons that burns, because of the peculiar junctions; however, practically, it will not set fire to things, as I will show you. I lay a piece of fuse on this paper and ignite it, you see the fuse burns over the paper without setting alight to it. I will lay another piece of fuse on the top of this train of gunpowder, and you see flame runs along the train of powder without firing it. I hope then I have convinced you the danger of this alarm exists only in fancy, not in practice. It is not necessary for me to say much with regard to it saving life from fire, as it is sufficiently obvious, if notice were always given of a fire when it was only a few feet in height, there would be no difficulty found in escaping from the house.

To sum up the arrangement contained in the former part of my paper, I would say, every fire has a beginning; if you discover the fire near this beginning, it is easily extinguished; let then every building be provided with an efficient fire alarm to give warning of this beginning, and to me it appears to follow disastrous fires will be almost a thing of the past.

After the reading of the paper, the chairman (W. Yates, Esq.,) invited discussion, and, in response, Messrs. Fischer, Carttar, and others put several questions to Mr. Blake, which he answered in such a way as to substantiate the statements contained in his paper. Votes of thanks having been accorded to Mr. Blake and the chairmsn respectively, the meeting ended.

SOLAR TRANSIT INSTRUMENT.

We extract from the "Polytechnic Bulletin," *Philadelphia Journal,* the following:—This instrument was invented thirty-six years ago, by Mr. W. A. Burt, who patented it. Since that time, very few modifications have been found necessary. The original instrument was made by W. J. Young, and since the expiration of the patent, as well as before, this house has, we are told, been the exclusive manufacturer. The instrument consists of an elongated plate, resembling that of a surveyor's compass, on one end of which is a transit telescope, on a single standard, with its accompanying level and vertical arc; on the other a brass vessel filled with lead as a counterbalance. The plate, which is graduated, is clamped to an upper circular plate, which in turn is clamped to the spindle. Observations on the sun at meridian are taken by so setting the instrument, that when the arc is moved to correspond with the sun's declination, a ray shall fall between the two parallel lines. We then have our north and south line and the upper plate is clamped. The needle used for determining the extent of magnetic variation, is contained in a compass-box, which is not circular, but oblong, its ends forming arcs of about 20 degs., and its sides re-entering so that the box resembles two opposite sectors of a circle, of which the point of the needle is the centre. A slow motion appliance brings arc and vernier to 0 deg. when the variation is read off.

The Scientific and Literary Review

Is published at the

OFFICES, 21, COCKSPUR STREET, CHARING CROSS.
LONDON, S.W.,

On the 1st of every Month, and sent post free on prepayment of the ANNUAL SUBSCRIPTION OF 6s. 6d.; or it may be had, by order, from Messrs. KENT AND CO., PATERNOSTER ROW, or any Bookseller or Newsagent in the kingdom, *price 6d. per copy.*

The SCIENTIFIC REVIEW, being well read by Manufacturers and Capitalists interested in inventions and enterprises for the promotion of industry, will be found a desirable medium to many Advertisers.

To Correspondents:—SCIENTIFIC COMMUNICATIONS AND BOOKS FOR REVIEW to be addressed to the Editor at this office; as also letters respecting ADVERTISEMENTS, SUBSCRIPTIONS, &c.—Correspondents are desired to keep copies of their communications, as the Editor cannot undertake to return them.

Editor's Office: 21, Cockspur Street, Charing Cross, S.W.

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE, LONDON.
ESTABLISHED 1ST MAY, 1862.

Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.—SESSION 1873-4.

Attendance of Members and their Friends is requested on—

THURSDAY, March 5th.—On "Raising Sunken Ships." By J. VAFEA, Esq.

THURSDAY, March 19th.—Conference of Council and Members on the Patent Laws.

The following are (exclusive of the above) the evenings for members' meetings for the remainder of the present session:—April 2nd, 16th, 30th; May (Annual General) 14th, 28th; June 11th.

TO MEMBERS OF COUNCIL.

Council meetings to take place at 7 p.m. on same evenings, when the attendance of all members of the Council is requested.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

At the meeting of the council (ordinary) held on February 5th, in consequence of the absorbing effects on the public mind of political events now occurring it was considered that no sufficient attendance could be expected to justify the disposal of important business; the only question entered upon was the action to be taken in regard to placing the case of the Patent Laws before the Government, and it was agreed that under present circumstances the matter must remain in abeyance.

The following gentlemen, having been admitted members of, were ordered to be entered on the list of members:—Messrs. F. Vafea, G. W. Hart, W. H. O'Shea, J. Edwards, W. A. White.

At the meeting of the council (ordinary) held on February 19th, 1874, after disposing of some formal business, the following gentlemen, admitted as members of, were ordered to be placed on the list of members:—Hodgkinson, Ardern, Atkinson, Surmon, Lloyd.

At the members' meeting, held at 4, St. Martin's-place, Trafalgar-square, at eight o'clock, p.m., on Thursday, January 22nd, 1874, M. M. Harris, Esq., member of the council, in the chair, Mr. Charles Fox Roe read his paper on "Communication Apparatus for Railway Trains." This was followed by a discussion, and a report is given in another column.

At the members' meeting on February 19th, 1874, held as above, Mr. W. Yates, member of the council, in the chair, Mr. P. A. Blake read his paper on "Suppressing Fires by Novel Automatic Means Indicating the Presence thereof in Buildings." This was followed by discussion, and will be found reported in another column.

Monthly Notices.

Heat disengaged in combination of Oxygen and Azote.—Recently, M. Berthelot brought before the Académie des Sciences a paper, "Sur la Chaleur dégagée dans les Combinaisons de l'Azote avec l'Oxygene." The importance of this inquiry in its relation to the explosive substances of late years introduced, makes it of very great importance.

Professor Asa Gray, of Cambridge University, U.S., and one of the associate editors of the *American Journal of Science and Art*, has been appointed by Congress to fill the chair in the Board of Regents of the Smithsonian Institution, previously occupied by the late Professor Agassiz.

The Mexican Society of Natural History issues in monthly numbers a journal, "La Naturaleza," containing the papers read before the Society. Amongt other matters, we find a notice of a new Mexican mineral. It consists chiefly of bismuth and tellurium, with a little silver, sulphur, and arsenic, and was found in the mine of Coneto, near Durango. There is also a paper "On the Combustible Minerals of Mexico," by the same mineralogist, Don Pedro L. Monroy; and one, "On the Meteoric Irons of Mexico," by Don J. Correjo.

Yield of Gold in Victoria.—The Report of the Secretary for Mines of Victoria, for the quarter ending September 30, 1873, states that 127,086 ounces of gold was obtained from the alluvial deposits, and 164,774 ounces from the quartz mines. During the quarter, according to the Returns from the Commissioner of Trade and Customs, 204,787 ounces were exported from the colony.

Dr. Beke, we hear, left Suez on the 18th Jan., in one of the Viceroy's steamers, for Akaba, the caravan having gone on by land. He confidently expects to be back in England in about a month's time.

Dr. Huggins has been elected by the Académie des Sciences of Paris as Correspondent in the Section of Astronomy, to replace M. Petit; and Mr. Newcomb has been elected to replace M. Valz, in the same section of the Académie.

German geology has recently lost two of her most distinguished professors in Dr. C. F. Naumann, of Leipzig, and Dr. A. E. Von Reuss, of Vienna. Naumann was originally a student, and subsequently a professor, at the Royal Saxon Mining Academy of Freiberg, whence he removed to the University of Leipzig. Equally distinguished as a geologist, a mineralogist, and a crystallographer, he has left behind a rich and varied collection of writings, including some of the best text-books of German science.

Ozone.—Professor Andrews, of Belfast, in a paper read at the Royal Society of Edinburgh, confirms his former experiments on this subject, demonstrating that this mysterious body exists independently in the atmosphere. Facility of change in the nature of ozone was shown by shaking it in a bottle with a little perfectly dried ground glass, when simple oxygen appeared. Dr. Andrews doubts the alleged connexion of atmospheric ozone with the state of public health. As a bleacher, upon trial at Belfast and Greenock, it had proved a failure.

Dr. Alleyne Nicholson, Professor of Natural History in the University of Toronto, has been appointed Professor of Zoology in the Royal College of Science, Dublin.

Electrical Communication in Mines.—At a meeting of the North Staffordshire Institute of Mining Engineers, on the 5th Feb., Mr. T. M. Goddard read a paper "On Communication between the Depths of a Coal-pit and the Surface by Electricity." We hope this subject will receive earnest attention.

Mr. John Pye, the Engraver.—The other day we recorded the death of Mr. Cornelius Varley, one of the oldest painters in Europe, who had exhibited pictures at the Academy not fewer than seventy years ago. We have now to announce the death, on the 6th February, of another aged artist, one of the ablest men in his profession whom this country has produced, a landscape-engraver of the highest class either in this or any former time, a master of the refinements of chiaroscuro, John Pye, who produced the plates after Turner, "The Temple of Jupiter in Egina" and "Ehrenbreitstein," and many other fine examples of the purest style and most poetic rendering of poetry in art. He was born in Birmingham in 1782. He was consequently within a few months of the age to which Mr. Cornelius Varley attained.

The Annual Dinner of the Members of the Institution of Civil Engineers has this year been fixed for Saturday, the 21st of March, at Willis's Rooms, St. James's.

RAILWAY TRAIN COMMUNICATION.

By C. F. Roe, Esq.

The following paper on this subject was read, and discussion occurred, at the meeting of the Inventors' Institute on Jan. 22nd, 1874:—

In bringing before you for consideration a new mode of railway communication, perhaps it may not be out of place to shortly review the events of the last few years, and the measures taken by the Board of Trade to ensure the necessity for the adoption of some means whereby travellers, in cases of danger, may inform those, in whose care they are, of their position.

In March, 1853, a committee of railway managers, appointed by the Clearing House, recommended the establishment of a communication between guard and driver, but were averse to the same for the use of passengers.

In 1855, the London and North Western Railway Company tried the electrical arrangement of Mr. Gluckman, but were compelled to abandon it.

In February, 1861, a French Commission of Inquiry reported that an electrical communication only would solve the problem, but were not in favour of giving the power of communication to the passengers. The Chemin de Fer du Nord, however, fitted up all their carriages with the electrical apparatus.

In 1864, a sub-committee of railway managers met to consider "the possibility of adopting some means of communication between the different parts of a train whilst in motion," and in April, 1865, they issued a report in favour of giving passengers the power of communication. In this year (December, 1864) Messrs. Preece and Bidborough patented an electrical system of communication, and were followed in January, 1865, by Mr. Walker, whose system has been working on the South Eastern Railway, and shortly after Messrs. S. A. Varley and Martin, whose system has worked on the London and North Western for about two years; being ultimately withdrawn.

In 1867 the Passenger and Guard Communication Act was passed.

To this succeeded the Railway Regulation Act, which made it compulsory on the part of railway companies to provide and maintain in good working order in every train running more than 20 miles without stopping, an efficient means of communication between the passengers and the servants of the company in charge of the train.

In 1870 the President of the Board of Trade gave his provisional sanction to the use of the cord, "The Board of Trade reserving to themselves the powers of reconsidering the question in the event of the system proving defective when tried on an extensive scale." This sytem having been tried for several years, its failure as a means of communication when resorted to on several occasions, led to an official investigation in 1871, and on July 15th, 1872, to the withdrawal of the provisional sanction, and the Board of Trade asked railway companies to adopt some other system they thought satisfactory.

This, then, is the present state of matters.

Let us now consider what are the requirements of a perfect system of communication, and what conditions should be fulfilled.

1st. The machine should be perfect.

2nd. Strong, and not liable to get out of order.

3rd. Inexpensive both as to cost and maintenance.

4th. Easy of access and simple in operation.

5th. The introduction of foreign carriages should not interfere with its working.

And Lastly. It should be detective.

These, then, we take it, are some of the important considerations in relation to the question before us this evening.

Let us apply to these tests the two kinds of communication before the public, viz., the electric and the cord.

WITH REGARD TO THE ELECTRIC.

We all know the liability of electricity at times to be beyond the power of man. The nicety and delicacy requisite to preserve an effective working condition; the expense of fitting up and keeping in order, and of technically educated men to keep it in order; the liability of thunderstroke interfering with the working, and rendering it inoperative at any minute when all other things may be in order.

WITH REGARD TO THE OTHER SYSTEM, THE CORD AND GONG.

This system can scarcely be called a novel one, and it seems to have every objection without any advantages accruing to it. We are all aware the cord is a nuisance whichever way we view it. First of all, few know where to find it, whether inside or outside the carriage, and when found we may have the same fate as Captain Tyler, who, on one occasion, is stated to have drawn in eighteen yards of cord without making any signal; then how liable it is to become jammed in the pullies, or to come off altogether; and what great power it requires to pull the rope taut owing to its weight and friction, whilst it easily may be cut, or broken intentionally or accidentally; its cost is far from small, nearly as much as the electric arrangement, and, finally, it has the great objection of being *non-detective*. I may here state that in 1868, on the London and North Western railway, there were 2,300 carriages, and at £3 12s. 0d per carriage, the cost for fitting up one of the electrical systems would be £8,301 11s. 0d., and that in 1871 it was estimated that the cord for the same railway company would cost £6,238 7s. 6d., or only one-fourth less.

I have now the honour to present for your consideration a third mode of communication, and that is the pneumatic one. Perhaps I cannot do better than read you the final specification of the patent, which is as follows, omitting a few not important sentences:—

NEW PNEUMATIC SOUND-SIGNAL SYSTEM.

On the tops of the carriages (though other positions may be adopted if desired), iron or other tubing for air (gas tubing for instance) is secured with branch pipes passing through the tops of and into the carriages, and having compressible air balls or bellows arrangements attached. The ends of the said tubing dip down to provide for the coupling of the tubing of one carriage to the coupling of another, so as to make the tubing throughout the whole train one continuous air tube or passage, whereby whistles or other sounders placed close to the guard and the engine driver, can be sounded by pressing the said air balls or working the said bellows. The provision for coupling consists in having the ends of the iron tubing threaded (if required) or suitably constructed, and by having a coupling piece of brass or other metal screwed or fitted therein or thereto, such piece being peculiarly formed with an indented part, and having above a projecting part to which a forked hook is secured, with a ball or weight for pressing the same home to its position. And in order to render the coupling more perfectly effective, the india rubber tube has its end externally thickened or flanged, so that the forked hook may take its place immediately beneath the thickened part or flange, and so maintain the rubber tube in its place notwithstanding the motion of the train. Coupling is effected by the above arrangements or any substantially the same in effect, such as the following:—One end of india rubber tubing is attached to tube on the carriage, the other end being attached to the coupling made of a circular piece of wood, metal, or other suitable material, formed with grooves or openings and projecting pieces, such coupling being on each end of the carriage. When, therefore, two carriages are required to be coupled, the projecting pieces on each are let into the grooves or openings, and then turned and held firmly together by means of a flange made on the projecting pieces, by which means coupling of the tube is effected. The india rubber tubing is likewise provided with a projecting piece, with an orifice in it to take in a hook to be secured to the end of the railway carriage, so as to attach thereto the india rubber tube and to prevent it being lost when being uncoupled.

After the reading of the paper the CHAIRMAN invited discussion, and in response,

Mr. MURRAY said he would like to know in what position the pipe that ran from carriage to carriage was situate.

Mr. ROE said that the pipe should be placed along the centre of the carriage, so that if a carriage were turned end for end a continuous connection would still be made. It could, however, be placed at the side, but if it were placed at the side the difficulty of coupling when turned end for end would be raised, though, by being at the side, it would in no way interfere with the doors of the carriages.

Mr. BELL observed that if it were intended to put the signal where the lamp was generally found, where would the lamp be placed? He assumed that Mr. Roe did not intend discarding the lamp altogether. Would it not be possible to have both lamp and signal in the centre of the carriage? He thought the lamp should still be placed in the middle, and to place the alarm in the middle would, he thought, he objected to. He would like to ask what was the estimated cost of fitting this apparatus.

Mr. MURRAY said, as regarded Mr. Bell's observation, that his (Mr. Murray's) idea was that the invention had better be placed at the side of the carriage, and not at the top, so that it would, if it were placed at the side, be low down and got at easily, and this would prevent the necessity of the signal-giver jumping up.

Mr. ROE, in reply to Mr. Bell, said that he thought the best place to adopt was where it could be best got at, and this, he thought, was the centre of the carriage. As regarded Mr. Murray's remark, he would state that his proposition involved the same objection as the cord principle, namely, that very few people would know where the alarm was. As regarded the cost of fixing, &c., he could not exactly say what it would amount to, though he thought it would not exceed one pound per carriage; but the cost would be materially lightened when a large number of carriages were to be fitted. One great objection raised against the cord system was overcome by this invention, for no cord was necessary, and all that was to be seen was the handle, and the bellows being fitted outside, it was impossible for any tampering to take place, and by this system all danger was reduced to a minimum.

A gentleman here observed that he could see by this invention there was no chance of cutting or disconnecting, but he would like to know whether more than one signal was given.

Mr. ROE said that three signals were given, and the indicator outside the carriage would show from what compartment the signal proceeded.

Mr. VARLEY thought that the invention was one that deserved careful consideration. Certainly some reliable system was wanted in these days of railway accidents. One thing that struck him in regard to this invention was whether the air in the bellows would be sufficient to exert the force necessary for giving the signal, and also that some allowance should be made for leakage at the juncture of the carriages. These points were of great consequence in case of long trains; and again, in case of a breaking away of part of a train, there would be no means that he could see that would enable the driver to ascertain or know that such a mishap had taken place. He thought that some means should be devised to meet this contingency, such as a cord running side by side with the air pipe, so that if a part of the train should happen to break away such would be indicated by striking a bell on the engine to which the cord was attached. He had been greatly interested in the means for securing the communication between passenger and guard, but more particularly with reference to the electrical system of communication.

Mr. **Roe** stated in regard to the indicating the breaking away of part of a train that there would be one great objection to the mode proposed by Mr. Varley, that such a system would create delay in coupling, and also that there would be difficulty in accomplishing that object.

The **Chairman** (Mr. Harris) observed that he had travelled a good deal in many countries, and, with regard to America, the system of communication was a slack cord hanging from the centre of the carriage, and all that was required to signal was to pull the cord; but then the construction of rolling stock in America rendered any elaborate system of communication unnecessary in consequence that through communication was available by reason of the construction of the cars, for a passenger, if he chose, could walk from one end of the train to the other, and if the train were to break the driver would instantly be made aware of that fact, but in this country it was another thing, and it was essential that some reliable mode of communication should be adopted, and he thought that the invention before them was one that recommended itself to the careful consideration of railway directors and those in authority in regard to railway matters. He had to propose that a vote of thanks be given to Mr. Roe, coupling also that of the inventor, Mr. G. Stapleton.

Mr. **Murray** seconded the vote of thanks, which was carried.

A vote of thanks to the Chairman, proposed by Mr. **Campin** (the Secretary) and seconded by Mr. **Roe**, was put and carried.

The meeting then separated.

PHYSIOLOGY OF THE SIAMESE TWINS.

Dr. Hollingsworth, of North Carolina, who examined the bodies of the Siamese twins at the time of their decease, found the band which connected them to be an extension of the sternum, for about four inches in length and two in breadth. The band was convex above and in front, and concave underneath. The two bodies had but one navel, which was in the centre of the band, and it is supposed that there were two umbilical cords branching from this, one extending into each body. The connecting link was found to be the ensifrom cartilage, and was as hard as bone, and did not yield in the least. (It may be here mentioned that, for some time previous to their death, no motions were observable in the band.) The doctor said that he did not think they would have survived a separation, not from the fact of being afraid of separating the arteries, but from fear of producing peritonitis. No hæmorrhage would have been produced, so far as could been seen, as there were no arterial connections of any account.—*Scientific American.*

The London and Provincial Boiler Insurance Company, Limited.—This is the title of one of the new companies located at Leadenhall-street, E.C., London, now in course of formation. The insurance of boilers, and increase of safety in use of them, which are the professed objects of this company, are of the very highest importance, as Manchester folk have long acknowledged. The parties connected with the company seem to be of high respectability; we may therefore look for its successful progress.

Proceedings of Societies.

ROYAL SOCIETY.

January 22nd.—The President in the chair.—The following paper was read:—"On the Nature and Physiological Action of the Poison of Naja Tripudians," by Dr. Brunton and Dr Fayrer.

January 29th.—The President in the chair.—The following papers were read: "Contributions to the Normal and Pathological Anatomy of the Lymphatics of the Lungs," by Dr. Klein,—and "On the Comparative Value of certain Geological Ages (or Groups of Formations) considered as items of Geological Time," by Prof. A. C. Ramsay.

February 5th.—The President in the chair.—The following papers were read: "On the Anatomy and Habits of the Genus Phronima (Latr.)," by Mr. J. D. Macdonald,—"On a Self-recording Method of Measuring the Intensity of the Chemical Action of Total Daylight," by Professor Roscoe,—and "Contributions to the History of Explosive Agents," Second Memoir, by Mr. F. A. Abel.

GEOGRAPHICAL SOCIETY.

January 26th.—The Right Hon. Sir H. Bartle Frere, K.C.B., President, in the chair.—The following new Fellows were elected:—C. F. R. Allen, Capt. L. N. F. Ames, W. M. Bell, Capt. H. F. Blair, W. Boyd, G. Bridgeman, C. G. Brown, T. R. Buchanan, Dr. Bushell, W. Cartwright, H. W. Cholmley, Lieut.-Col. E. S. Daniell, D. Davidson, E. Dowling, W. Evill, Commander O. A. Forssman, Lieut. W. J. Gill, J. H. S. Graham, E. Hairby, Capt. F. Hamtley, Dr. S. S. Heard, Lieut.-Col. J. Hills, Dr. J. Kennedy, A. J. L. Learmouth, D. H. Macfarlane, S. Mason, C. E. Matthews, Lieut.-Col. A. Pearson, E. Power, J. Reynolds, J. L. Ridpath, E. Routledge, R. Smith, Duke of St. Albans, T. Waters, R. Wharton, H. E. Wodehouse, C. E. B. Young.—The paper was "Geographical Notes of the Khedive's Expedition —The author, who accompanied his uncle, to Central Africa," by Lieut J. A. Baker, R.N. Sir S. Baker, throughout his late expedition, gave in this paper the details of his geographical observations, which related chiefly to the obstructions caused by aquatic vegetation to the navigation of the main stream of the Nile, and to the reported connection between lakes Albert, Nyanza, and Tanganyika. The information received by Sir Samuel and his party regarding the latter point, was from native traders, who said they had travelled by boat from one lake to the other, by a tortuous channel, through which it is necessary to be piloted by persons who are acquainted with the intricacies of the navigation.—In the discussion which followed, Sir S. Baker reminded the meeting that the observations of altitude taken by Livingstone in the southern part of Tanganyika, and by himself on the Albert, showed very nearly the same elevation for the two waters, and he reconciled the fact observed by Stanley of the inflow of the Rusizi on the north of Tanganyika, by the fact that the rainy season occurred at different times in the two lakes, and that the water flowed sometimes towards one lake and at other times towards the other.

February 9th.—The Right Hon. Sir Bartle Frere, K.C.B., President, in the chair.—The following Fellows were elected: Capt. P. C. H. Clarke, Lieut-General R. F. Copland-Crawford, Capt. T. W. Goff, Hon. R. H. Manners-Sutton, Col. F. Tighe, Rev. J. Davis, Messrs. C. G. Barclay, J. Bray, S. Bristow, J. B. Brown, A. Folkard, H. C. Forde, W. T. Hunt, M. F. Keller, G. Knowles, C. R. Marten, W. F. Scholfield, and R. Stewart.—The paper was, "A Journey Outside the Great Wall of China," by Dr. S. W. Bushell. The route taken was north-westerly through inner Mongolia to Kalgan, and thence north-easterly to Dolonnor (a large town whose exact position was previously unknown), and Shang-tu, the old northern capital of the Yuan dynasty, described in glowing terms by Marco Polo. The ruins of Shang-tu, built by the famous Kublai-Khan, were identified by the existence of a marble tablet, with an inscription of the thirteenth century. It is the place referred to by Coleridge in the lines—

> In Xanadu did Kublia Khan
> A stately pleasure dome decree, &c.

The author found the site a complete desert, overgrown with rank weeds and grass, the abode of foxes and owls, which prey on the numerous prairie-rats and partridges. The walls of the city, built of earth, faced with unhewn stone and brick, are still standing, but are more or less dilapidated, and the enclosed space is strewn with blocks of marble and other remains of large temples and palaces; while broken lions, dragons, and the remains of other carved monuments, lie about in every direction, half hidden by the thick and tangled overgrowth. From Shang-tu the author travelled south-easterly, past the great enclosed park called the Imperial hunting grounds, to the city of Jehol, and thence to Pekin. A second paper was read, by Mr. G. Phillips, entitled "Notices of Southern Mangi."

GEOLOGICAL SOCIETY.

January 21st.—Prof. P. M. Duncan, V.P., in the chair.—Messrs. E. Gilpin and T. R. Mellor were elected Fellows.—The following communications were read:—"Extract of a Despatch from Mr. Williams, H.M.'s Consul at Samoa, dated Sidney, Oct. 28th, 1873." "The Secondary Rocks of Scotland: Second Paper, On the Ancient Volcanoes of the Highlands and their Relations to the Mesozoic Strata," by Mr. J. W. Jubb; and "Remarks on Fossils from Oberbury, Styria," by Mr. A. W. Waters.

February 4th.—The Duke of Argyll, President, in the chair.—Messrs. T. Stevenson, H. Fisher, M. Delmard, and J. D. Kendall, Corporal W. Parsons, R.E., and Col. W. Boyle, were elected Fellows.—The following communications were read: "The Physical History of the Valley of the Rhine," by Professor A. C. Ramsay, and "On the Correspondence between some Areas of Apparent Upheaval and the Thickening of Subjacent Beds," by Mr. W. Topley.

CHEMICAL SOCIETY.

February 5th.—Prof. Odling, President, in the chair.—"A Preliminary Notice on the Action of Benzyl Chloride on the Camphor of the Lauraceæ (*Laurus camphora*)," by Dr. D. Tommasi, was read by the Secretary.—Dr. C. R. A. Wright had a paper "On the Isomeric Terpenes and their Derivatives, Part III., on the Essential Oils of Wormwood and Citronelle," being a detailed account of his experiments on these substances, a preliminary notice of which was communicated to the Society some time since.—The other communications were, "A Preliminary Notice on the Perbromates," by M. M. Pattison Muir,—and "On the Coals from Cape Breton, their Cokes and Ashes, with some Comparative Analyses," by Dr. H. How, the latter paper giving the amount of coke produced by slow and quick coking, from the main seam coal of Sydney Mine, Nova Scotia, and the Lingan Coal, also analyses of the ashes left by these coals.

MICROSCOPICAL SOCIETY.

February 4th.—Anniversary Meeting.—C. Brook, Esq., President, in the chair.—Mr. J. S. Crisp was elected a Fellow, and numerous donations were announced.—The Report of the Council and the Treasurer's Statements of Accounts were submitted and adopted, and the Officers and Council for the ensuing year was elected. The Annual Address to the Society was delivered by the

President, in the course of which, after reference to their present position and future prospects, he gave a critical review of the most important papers brought before their notice during the year; alluded to the microscopical apparatus exhibited at the Vienna Exhibition; and concluded with obituary notices of Fellows deceased since the last Annual Meeting.—The following gentlemen were elected as Officers and Council: President, C. Brooke, M.A.; Vice-Presidents, Dr. R. Braithwaite, J. Millar, W. K. Parker, and F. H. Wenham; Treasurer, J. W. Stephenson; Secretaries, H. J. Slack and C. Stewart: Council, J. Bell, F. Crisp, Dr. W. J. Gray, J. E. Ingpen, S. J. M'Intire, H. Lee, W. T. Loy, Dr. H. Lawson, H. Perigal, A. Saunders, C. Tyler, and T. C. White.

VICTORIA (PHILOSOPHICAL) INSTITUTE.

At a recent meeting of this Institute which took place at its rooms, 8, Adelphi-terrace, C. Brooke, F.R.S., in the chair, several new members were elected, and donations to the library announced from Dr. Lionel Beale, Professor Dawson, and others, after which it was stated that the number of members elected last year had been 110, a number slightly in excess of that in the year 1872. A paper by the Rev. J. H. Titcomb, on "Magnitudes in Nature, and their Bearings on Biblical Interpretation," was then read, in which the latest discoveries in geology and astronomy were reviewed, and shown to be in no way at variance with what a careful student of Holy Writ would be led to expect. At the conclusion of the paper, one by Professor Challis, F.R.S., criticising some portions of the arguments, and advancing several others, to strengthen the position taken by Mr. Titcomb, was read; as also communications from the Radcliffe observer, Professor Pritchard, and the Astronomer Royal's department, bearing upon and supporting the arguments derived from astronomy. The latter stated,—"In regard to the central point of the Solar System, that the evidence of the spectroscope, so far as it went, seemed to confirm the supposed motion of the Solar System towards Hercules, and that it appeared probable that the centre of motion of the Solar System was somewhere in the direction of Alcyone." An animated discussion ensued. On Monday February 2nd, Mr. Howard read his paper on the contrast between "Crystallization and Life." Fourteen new members were also elected.

ZOOLOGICAL SOCIETY.

FEBRUARY 3RD, 1874.—Dr. E. Hamilton, Vice-President, in the chair. The Secretary read a report on the additions that had been made to the society's menagerie during the month of January, 1874, amongst which were specially noticed a female water-deer (*Hydropotes inermis*), a pair of pink-headed ducks (*Anas caryo-phyllacea*), and a dusky monkey (*Semnopithecus obscurus*), acquired by purchase, and two vulturine guinea-fowls (*Numida vulturina*), presented by Dr. J. Kirk, C.M.Z.S. An extract was read from a letter addressed to the Secretary by Mr. Luigi M. L. Albertis, C.M.Z.S., containing an account of a new species of kangaroo, of which he had lately obtained a living specimen from New Guinea, and which he had proposed to call *Halmaturus luctuosus*. Dr. Cobbold communicated the second part of a series of papers entitled "Notes on the Entozoa;" being observations based on the examination of rare or otherwise valuable specimens contributed at intervals by Messrs, Charles Darwin, Robert Swinhoe, Charles W. Devis, the late Dr. W. C. Pechey, Dr. Murie, and others. Mr. Garrod read a paper in which he proposed a new classification of birds, founded mainly on the disposition of their muscles and other soft parts. The five muscles which he had observed to vary most were the ambiens, the femoro-caudal, the accessory femoro-caudal, the semi-tendinosus and the accessory semi-tendinosus. After stating which of these are present or absent in the different families of birds, he showed that the presence or absence of the ambiens muscle is so intimately correlated with other characters that a division of the whole class into *Homalognati* and *Anomalogonati*, depending on that peculiarity, would stand the test of much criticism. The homalogonatous birds were divided into the galliformes, the anseriformes, the ciconiiformes and the charadriiformes; the anomalogonateous into the passeriformes, the piciformes and the cypseliformes. Among the most important changes proposed or substantiated were the placing *Serpentarius* and *Cariama* with the otididae, the cypselidae with the trochilidae, and the musophagidae among the galliformes.

February 17th.—George Busk, Esq., F.R.S., Vice-President, in the chair.—Mr. Busk exhibited some skulls of the tiger and leopard from China, procured by Mr. R. Swinhoe, and showed that those from the northern and southern provinces did not appear to be specifically distinct. A communication was read from Mr. L. Taczanowski, Conservator of the Museum of Warsaw, containing the descriptions of 24 new birds, obtained by Mr. Constantine Jelski in Central Peru. Amongst these was a new Cotingine form, proposed to be called *Dolyornis sclateri*, and the four new humming birds, named respectively *Metallura Hedvigae, Helianthea dichroura, Eriocnemis sapphiropygia* and *Lampraster branickii*. A communication was read from Sir Victor Brooke, Bart., describing a new species of gazelle, founded on two specimens living in the Society's Menagerie, which he proposed to call *Gazella muscatensis*. A communication was read from Dr. T. Schomburgh, Director of the Botanic Gardens, Adelaide, containing an account of the habits of the Australian coote (*Fulica australis*) as observed in the Gardens under his charge. Mr. E. Ward, F.Z.S., exhibited the head of a supposed new species of wild sheep, from Ladak, which he proposed to name *Ovis brookei*, after Sir Victor Brooke. Dr. J. E. Gray, F.R.S, communicated some notes on the crocodile of Madagascar, which he proposed to distinguish from *Crocodilus vulgaris* of Continental Africa, and to call *Crocodilus madagascariensis*. A communication was read from Mr. W. N. Lockington, of Humboldt County, California, containing some notes on the mammals and birds met with in that part of the State of California.

INSTITUTION OF CIVIL ENGINEERS.

FEB. 3RD.—Mr. T. E. Harrison, President, in the chair.—Forty-one candidates were elected, including five members, viz.: Messrs. J. C. Bailey, W. Bell, W. Foulis, A. Moncrieff, and M. Paterson. Thirty-six gentlemen were elected associates, viz: Major W. Crossman, Major-General H. Y. D. Scott, Messrs. H. Barratt, H. P. Boulnois, E. B. Bright, M. Bromley, W. A. Brown, G. H. Chubb, W. Conyers, W. Cooper, C. Copland, A. L. Cousins, J. Douglas, S. J. Dunlop, J. H. Eykyn, J. E. Fisher, J. E. Hannah, C. W. E. Henslowe, R. R. P. Hickson, W. F. Howard, J. Jackson, P. T. S. Large, J. E. Lowe, J. M'Ritchie, F. G. Mann, J. Menzies, J. Penn, R. Pinchin, W. H. Roberts, W. H. Stanger, J. Strachan, L. Trench, G. A. Twynam, E. H. Vernon, P. L. Weatherhead, and C. G. Wilson. The Council had recently admitted the following candidates as students, viz.: Messrs. H. O. Baldry, C. W. Scriven, A. H. Thompson, and H. J. Tingle.—The paper read was, "Description of the Brighton and Hove General Gas Company's Works, Portslade, Sussex," by Mr. J. B. Paddon.

February 3rd, 1874.—Thos. E. Harrison, Esq., President, in the chair.—The paper read was a "Description of the Brighton and Hove General Gas Company's Works, Portslade, Sussex," by Mr. John Birch Paddon, M. Inst. C.E. The election of the members before-named took place at the monthly ballot.

February 10th.—T. E. Harrison, Esq., in the chair.—The paper read was, "On the Construction of Harbour and Marine Works, with artificial blocks of large size," by Mr. B. B. Stoney. [This paper will be found in another page.]

ROYAL INSTITUTION.

FEB. 2ND.—The Duke of Northumberland, D.C.L., President, in the chair.—The Lady Claud Hamilton, the Right Hon. G. J. Goschen, the Rev. F. Braithwaite, Messrs. R. S. Faulconer, H. F. Harwood, S. H. Harwood, R. J. Taylor, and J. C. Zambra were elected members.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

FEBRUARY 3RD.—Sir H. Rawlinson, K.C.B., D.C.L., F.R.S., in the chair.—The following paper was read for the author by Mr. R. Cull: "On the Astronomy of the Assyrians, with Translations from the Cuneiform Inscriptions," by the Rev. A. H. Sayce, M.A.

ANTHROPOLOGICAL INSTITUTE.

JAN. 27TH.—Anniversary Meeting.—Professor Busk, President, in the chair.—The President referred to the finances of the institute. Although the receipts are adequate for the necessary expenditure on the present economical principles of management, they do not allow the society to pay off more of the debt or to enlarge the scope and usefulness of the institute. Until the indefensible secession of members early in 1873 on a purely personal question, the institute, since its formation, had paid off the combined debts of the two old societies at the rate of £100 a year. He appealed to the members to make a united effort to extinguish the debt of £800. A year's income would do it. The President further announced that nearly £250 had been promised by members present at a council meeting held that day, provided the sum of £500 be contributed by other members of the institute. The President then delivered the annual address, in which he viewed the work done during 1873 by English and foreign anthropologists. Amongst a large number of topics, he adverted at considerable length to the important contributions to craniometry by Dr. H. Von Jhering and Dr. P. Broca, criticising the respective methods employed by those distinguished anthropologists; and concluded that part of his address with the observation that the study of craniology is almost futile when applied to highly civilised, and, consequently much mixed, peoples, and that its results are the more certain in proportion to the purity of race; that purity at the present time was rapidly disappearing, and with it the surest data for the determination of the problems involved in the antiquity and physical origin of man. The following officers and council were elected to serve for 1874:—President, Professor G. Busk; Vice-Presidents, J. Evan, Colonel A. Lane Fox, A. W. Franks, F. Galton, Professor Huxley, and Sir J. Lubbock, Bart.; Director, E. W. Brabrook; Treasurer, Rev. D. Heath; Council, Dr. J. Bednoe, W. Blackmare, H. G. Bohn, Dr. A. Campbell, Hyde Clarke, Dr. J. B. Davis, W. Boyd Dawkins, R. Dunn, D. Forbes, Sir D. Gibb, Bart., G. Harris, J. P. Harrison, J. F. M'Lennan, C. R. Markham, F. Ouvry, F. G. H. Price, J. E. Price, F. W. Rudler, C. R. Des Ruffières, and E. B. Tylor.

DISTRESS AND OTHER PYROTECHNIC SIGNALS.—Fxperiments have been instituted in the Crystal Palace Grounds by Messrs. Brock and Co., of Nunhead, on the above subject.

KILN BUILDING.

George Cowdery, of Exmouth, Devon, has recently patented improvements in the manufacture of bricks or blocks useful for the improved construction of buildings of various kinds, the improved construction of kilns forming part of the said invention. In his specification he states:—

I form with clay or brick earth, *hollow* bricks or blocks which I term terra ashlar builders. These I make of any suitable size, say 2ft. 3in. long, 9in. deep, and 14in. wide, whereby I reduce the weight of 14in. brickwork about two-thirds. In order to properly dry and burn these bricks, I construct drying rooms, and kilns, or ovens, the drying rooms deriving their heat from the kilns, which I prefer to construct in a circular form, having continuous ring-form burning chamber, or chambers, and a drying room outside the kiln, but heated therefrom (usually from the burning chamber); the heat passing with the smoke beneath the floor of the drying room, and escaping up the chimney, situate at the end of the drying room. The central space encompassed by the ring formed, or continuous burning chamber, is occupied by a drying chamber or room, which is also connected to the outer drying room by pipes or ducts in communication with the flue for conveying heat to the said outer drying room. In erecting buildings with these blocks, air should be admitted near the surface of the ground, say, by perforations in the plinth, and free circulation be obtained between the walls of blocks, with outlet round each flue on the top of chimney, and as there will be only about 1¼ inches thickness of blocks at back of fire-place, the air between the building blocks becomes warmed, and makes its exit round each flue as before named, carrying the smoke clear of flue, thereby preventing down draught. When my improved construction is adopted, in the event of adjoining premises being on fire the partition wall would become heated, but as fresh air is admitted at the bottom of the building, it would rapidly carry off the heated air, thereby preventing contact.

For greater safety, I would recommend the use of revolving iron shutters to all windows, as also the kyanizing of all timbers used in building, by which means fire from within would not spread. Although I have described my invention as a whole, it will be evident that parts can be used separately, for instance, for plinths, quoins, string courses, window and door heads and jambs, cornices, garden walls, and so forth; and the drying rooms and burning kilns can be also used for pottery, common brick making, lime, and so forth.

GADD'S STEAM GENERATING INVENTION.

The methods that have been hitherto employed for the combustion of oils of various kinds for the generation of steam and other purposes, have, for the most part, either conveyed the oil to the furnace on fluted bars, have converted it firstly into gas in retorts, or have projected it into the furnace by means of a jet of steam or air, acting as a blow pipe; by means of which the oil is carried in a spray form along the flues, and by combustion converted into flame. Of these various methods, the last seems to offer the best chances of success; but by this means great waste results when the oil pipe is inserted into the nose of the blowpipe near its orifice, as great quantities of oil become blown through the furnace without having been burnt, or go off in smoke, and when this is sought to be remedied by allowing the oil pipe to run inside the steam pipe some distance, say, beyond a few inches for the purpose of volatilizing the oil in some measure, it is found that the more solid portions of the oil sought to be used choke up the passages, and so stop the working.

The object of Mr. Gadd's improvements is to remedy these defects, for which purpose he allows the oil not only to enter the steam pipe or chamber, but to mix or become in suspension with the steam at a convenient distance from the orifice or orifices opening into the furnace or flue. And along this furnace or flue, by preference, he fixes, in connection with the steam pipe a perforated pipe, or pipes, or chamber, from which perforations the oil charged steam will be emitted in various directions, so causing a number of jets to impinge upon the boiler flue of bottom (according to construction) or the furnace crown. By which means a greater separating or diffusing of the oil takes place than when a simple jet carries the oil along the length of the furnace or flue Or the steam may be charged with oil by allowing the steam to pass through a vessel or pipes containing the oil. To provide further against the waste of any portion of the oil that may escape combustion in the first instance, he adopts the following methods:—Either he covers the bottom of the furnace with "asbestos," or with a vessel or tank of water which will catch the unconsumed oil when it falls and retain it until it has time for proper combustion. The oil may also be burnt by projecting the same into, through, or on to the water or "asbestos," direct, or in combination with steam by any suitable means. The inventor and patentee is Mr. W. Gadd, of Manchester.

TO INVENTORS.

C. E. G., in the *Scientific American*, lays down the following maxims for the guidance of inventors:—

1. Know definitely what you want to accomplish, stick to it, and let other matters go, for the time.
2. Post yourself thoroughly as to the laws governing the action of each part of your machine.
3. Always bear in mind that whatever is gained in time is lost in power, and *vice versa*.
4. Think over every machine, of a nature similar to yours, which you have seen; and when your idea is clear in your head, compare it with those of inventors who have preceded you in the same line.
5. Be sure that the cost of your device will not prevent its use.
6. Avoid all complicated arrangements; make every machine of as few parts as possible.
7. Imagination, judgment, and memory are the faculties to employ. Imagination will bring forth new forms and actions, judgment will compare them with other devices and determine their relative value, and memory will store up the results for future use.

CHEMICAL NOTES.

Under this head the *Athenæum* states that Prof. Hermann Vogel contributes to the *Berichte der Deutschen Chemischen Gesellschaft zu Berlin*, some notes "On the Sensibility of the Bromide of Silver to Light, especially to the Chemically-inactive Colours." He maintains that the bromide of silver is sensitive to rays of light which have hitherto been thought to have no photographic action, and, that he finds the bromide of silver, when dry, is more sensitive to the less refrangible of the visible rays of the solar spectrum, but, when moist, to the more refrangible rays. He thinks it possible to render the bromide of silver sensitive to any desired ray of the spectrum. He publishes this as a new discovery, although Sir John Herschel, in his memoir "On the Action of the Rays of the Solar Spectrum," published in the *Philosophical Transactions*, 1840, says of the bromide of silver, "But the most characteristic peculiarity of the spectrum is its extravagant length. Instead of terminating at the mean yellow ray or thereabouts, the darkened portion extends down to the very extremity of the visible red rays;" and Mr. Robert Hunt, in his "Researches on Light," 1844, shows that this salt is affected by nearly all the rays; and in the second edition, in 1854, he writes, "As soon as the prismatic spectrum falls upon paper prepared with this salt (bromide of silver), it blackens over the whole extent of action with nearly equal intensity." Continental chemists are often curiously ignorant of the labours of their English brethren.

It is well known that solutions of many salts of ammonia, though originally neutral or even alkaline, become more or less acid in their re-actions as they slowly evaporate. This curious decomposition has been lately studied by Dr. Dibbits, of Amsterdam, who has published a paper "On the Dissociation of Ammonium-Salts in Solution in Water."

Dr. Schrauf has laid before the Academy of Sciences of Vienna a monograph on those basic sulphates of copper which occur in native forms, and are grouped together under the general name of Brochantite. After an elaborate description of the chemical and morphological characters of these minerals, he discusses the re-actions by which compounds of similar constitution may be obtained as laboratory products, and refers to the experiments of Mr. Field and other chemists who have conducted investigations on this subject.

EXHIBITION OF APPLIANCES FOR THE ECONOMICAL CONSUMPTION OF FUEL.

This exhibition, inaugurated by the Society for the Promotion of Scientific Industry, a young association, which, if it has not brought to the front all the most modern ideas on the subject of coal economy, is, nevertheless, most certainly deserving of credit for having made a very satisfactory start in the right direction, and for having provided the public of Manchester and Salford with an exceedingly interesting exhibition.

Space now at our disposal will not admit of an extended report in the present issue; but we hope in a future number to lay before our readers the principal points of interest, and the lessons to be drawn from the collection of apparatus, brought together in the large wooden shed at Peel-park, Salford. As far as we have yet been able to notice, the exhibitors belong chiefly to Lancashire and Yorkshire, so that the thought which is represented may be considered more or less of a local character.

The nature of the exhibits consist of what are technically known as "economisers," that is to say, various arrangements for utilising the waste heat from steam boilers and other furnaces, as applicable to steam engines, for reducing the use of steam to the minimum; of fire-bars for furnaces, with a view to the economical consumption of coal; of peat and peat compositions, with other artificial fuels; of new forms of boilers, tubular and otherwise; of machinery for winning coal from mother earth; and lastly, of numerous forms of stoves and firegrates for domestic purposes, not omitting a show of different arrangements for heating by means of gas.

The exhibition, which at first from a variety of causes attracted but little notice, seems to be steadily progressing in public favour; and great numbers of attentive students of the great fuel question may be now daily seen carefully and critically examining the various inventions there laid before them.

We shall return to the subject with pleasure; and, in the meantime, we heartily wish the committee every success in their endeavour.

We think it right to state that by the aid of Mr. W. Gadd, C.E., of Manchester, we are enabled to present the above to our readers.

APPLICATIONS FOR LETTERS PATENT.

(Continued from page 30.)

Coventry. Tools or machinery for turning, screwing, drilling, and boring.—J. B. Stearns. Electric telegraph apparatus.—S. Gould. Washing machines.—A. Pickup and S. Carter. Sewing machines.—G. W. Rendel. Mounting ordnance.—R. Wilson. Hydraulic presses, and steam engines for working the same, which engines are also applicable for working hydraulic hoists and cranes.—A. Nicols and J. F. N. B. Simons. Method of preserving animal and vegetable substances.—I. B. Harris. Hose and tubing.—I. B. Harris. Flexible tubing.—O. D. Renaudon. Ornamental surfaces applicable as coverings for courts and ways.

On November 28th.—3888 to 3901.—E. Allen. Glazing or burnishing leather.—E. Hawken. Appliances for economising the consumption of fuel.—J. Steel. Apparatus for actuating the brakes of railway trains by compressed air —J. Lee. Telescopic street orderly bin for collecting refuse in the streets.—E. Diver, M.D. Obstetric apparatus. H. B. Sale and A. Martin. Stamp for marking or stamping paper, linen, and other textile fabrics. W. Hutchison. Steam engines. —W. Hodgson and F. Lea. Spinning and twisting wool and other fibres.—E. Dickinson. Apparatus for making the moulds for spur and other toothed wheels.—L. Chelot. Manufacture of nails, bolts, metallic wires, and other similar means of attachment or connection.—S. Bevan. Photographic and other albums, and reference and other books for turning over the leaves of the same.—A. V. Newton. Improved mode of finishing felted goods (com.) W. Fisken. Apparatus for heating or warming buildings, also for cooking purposes.—W. R. Lake. Machinery for drilling or boring rocks and hard substances (com).

On November 29th.—3902 to 3922.—R. Morton. Refrigerators or apparatus for cooling liquids, parts of which are applicable to distillation, surface condensation, heating or cooling fluids, air, or gases.—A. Pinney. Thermometers for bakers' and other ovens.—S. Alley and J. B. Handyside. Fastenings for connecting and strengthening the ends of rails for railways or tramways, and apparatus for applying the same. G. Edwards. Stoves.—H. Smith. Candle holders.—J. Hicks. Apparatus for saving life at sea.—G. Allibon and A. Manbre. Safety valves.—G. L. Shorland. Fire grates of kitchen ranges, also other descriptions of fire grates.—J. Bell, jun., and R. Bell. Utilizing waste heat of materials employed in retorts and apparatus employed therefor.—C. Slagg. Hearth box for collecting the fine ash of house fires, and separating the cinders therefrom.—G. L. Scott and W. E. Hayes. Cupolas and blast furnaces, or other furnaces used for similar purposes.—H. W. Hart. Shirts and other articles of wearing apparel.—W. T. C. Pratt. Safety apparatus for railway trains.—F. Brown. Register stoves or grates.—F. G. Underhay and A. E. Carter. Apparatus for preventing waste of water.—J. Noad. Envelopes for the protection of bottles and such like.—T. S. Monkhouse. Printing, and apparatus for cutting the printed matter at the same time.—W. R. Lake. Flash-light signal apparatus or night telegraph (com.)—H. Rahtjen. Antifouling and preservative composition for ships' bottoms and other submerged structures.—J. R. McVoy. Machine for cleaning and polishing boots, shoes, plate, and other articles.—J. R. Lancaster. Combination tool.

On December 1st.—3923 to 3940.—H. Beasley. Apparatus for stamping linen with name or initials.—E. Clarke, G. Clarke, and H. E. Harrold. For economizing fuel and preventing smoke in furnaces for boilers, pans, and other heating or evaporating apparatus.—F. Lloyd. Fire grates and their appurtenances.—V. Chambon. Plough.—S. Johnson. Fire escapes by a lift.—J. Kenyon. Economising fuel in fire-grates or stoves for domestic and other purposes. —T. E. Williams. Apparatus for extracting the gases of smelting and other furnaces.—J. E. Beanland. Quadrants for opening, shutting, and fastening windows, and apparatus employed therein.—W. M. Beaufort. Method of making joints.—H. Hebert. Pianofortes and other keyboard instruments.—T. J. Smith. Apparatus for grinding and surfacing the exterior of cylinders, rollers, and drums (com.)—J. M. Plessner. Motive power engines.—W. H. Yeomans. Needle cases.—H. A. Egerton. Construction of ships, ferry boats, and other vessels.—J. H. Johnson. Treatment of sugar cane for the manufacture of paper pulp therefrom (com.)—J. H. Johnson. Polishing and glazing photographic proofs, and apparatus employed therein (com.)—B. T. Moore. Current meters, water meters, and ships' logs.—D. Greig and R. Burton. Apparatus for actuating steam ploughs and other agricultural implements.

On December 2nd.—3941 to 3955.—R. Russell. Stoves and kitchen ranges.—A. Smith and F. Field. Decolourizing of solid and liquid hydrocarbons, and the application of materials for that purpose.—E. Verdeau. A new electric pile, said Miguel's pile, to be used in the telegraphy, in the locomotion, and in the electrical lighting.—H. Bessell and J. A. Wheeler. Paliasses.—B. Haas, jun. Watches.—J. J. Perry and W. E. Wiley. Pens or marking instruments.—B. C. Lauth. Machinery for rolling iron and other metals (com.)—E. R. Morris. Pocket instruments for measuring and registering distances.—A. Kruger and T. Colani. Saccharification of grains.—A. Millar. Portable apparatus for scoring or registering numbers. —L. Bouttier and M. J. B. Conhault. Shears or clips for shearing or clipping sheep.—R. H. Manning. Railway breaks.—F. A. Paget. Mode of and apparatus for softening and purifying water (com.)—J. H. C. Zanzic. Combined garment.—J. Wyatt. Apparatus for signalling between the different parts of railway trains, and partly applicable for opening and closing the doors of railway carriages.

On December 3rd.—3956 to 3976.—W. E. Gedge. Button and novel process of button fastening (com.)—B. L. Thomson. Sheathing or covering ships' bottoms and other surfaces, and the plates to be employed therein.—J. Wilson. Cover or backing for books.—A. C. Henderson. Matchboxes for automatically lighting the matches (com.)—A. M. Dillet. Checking fares to be taken in omnibuses, cabs, and other public or private vehicles, and also for indicating the distance travelled by them.—W. T. Holland. Fettling for puddling and boiling furnaces.—W. Cunningham. Machinery for carding jute, flax, hemp, and other fibrous materials, and in part applicable to the delivering parts of other machinery.—C. Stuart, W. Jagger, J. Smith and J. Pilling. Safety valves.—J. Clarkson. Fastening, connecting, or securing artificial teeth.—W. Adair. Fog horns.—F. G. Pearson and J. Grinold. Manure and other similar forks.—C. Barton. Preserving or protecting, ornamenting, finishing, or emblazoning the whole or certain parts of locks and latches.—J. Cawthorn. Movable sashes and their frames.—J. Worrall. Machinery for finishing cut-pile fabrics. —W. E. Newton. Apparatus for signalling by night (com).—L. Oppenheimer. Tiles or slabs for floors or walls.—E. Pickering. Permanent way of railways.—B. F. Fuller. Printing press (com.)—B. F. Fuller. Automatic paper feeder for printing presses and other machinery (com.) —C. P. Weatherby. Process and apparatus for preserving wood.—J. E. Russell. Tucking devices and guides for sewing machines (com.)

On December 4th.—3977 to 3999.—W. Perch. Supplying compressed air to machines or apparatus for the purpose of obtaining motive power. —W. R. Lake. Welding iron and steel (com.) —S. Samuel. Construction of rolls for wool washing and other machinery, and for the purpose of pressing the moisture out of wool and cotton fibres, and also other materials (com.)—W. Tasker. Machinery for forming and welding and finishing couplings used for connecting steam, gas, and water pipes (com.)—E. Storey. Bed applicable for saving life at sea.—W. Jones. Apparatus for uniting, by sowing together or seaming, parts of looped knitted or other fabrics. —W. Whittle. Fire-places and the mode of heating ovens or apparatus used in cooking for domestic purposes.—T. Suffield. Foot warmers, carriage heating and bed airing apparatus.—P. Vigouroux. Manufacture of certain bituminous materials.—J. Burton. Fastner for windows. J. B. Delavault. Advertising envelope and combined letter paper.—J. Welch. Means for protecting the coverings of umbrellas, parasols, and similar articles.—W. E. Gedge. Embroidering machine, termed "Bonnaz couso-brodeur" (com.)—A. Beque. Proceedings in panifications.—H. A. Bonneville. Means for using with the sewing machines the thread balls (com.)—A. Kaiser. Automatic balance to be used for weighing grains, farina, and other similar substances.—J. Mallison. Processes of bleaching, mordanting, and dyeing yarn.—W. Ramsey. Glass cutting instruments.—J. Davis. Lubricators. (Complete specification.) — J. Tweedy and J. Simpkin. Locking apparatus for controlling and working signals and points. —W. Hooper and J. M. Dunlop. Telegraph cables and covering telegraph conductors.—A. M. Clark. Folding chairs and other articles of furniture (com).—W. L. Anderson. Apparatus for obtaining and preserving equilibrium in ships' cabins, such cabins being available for saving life at sea in cases of wreck.

On December 5th.—4000 to 4014.—P. R. de d'Humy. Stoppers for bottles, &c.—T. G. Messenger. Pipe joints and couplings.—W. Southwood and C. Mathews. Propelling ships. —R. Heywood. Horse collars (com).—E. Hinchliffe. Machinery for flocking woollen or other woven or felted fabrics.—W. B. Redish. Fire-grates.—I. Careless. Horse collars.—J. H. S. Wildsmith. Artificial manure.—D. McDowell. Churn.—L. D. Phillips. Fittings for the reception of saliva to railway carriages and other public and private carriages.—J. E. West. Trellis suitable for training vines or other trees.—P. Hubert, jun. Stoppering flasks, bottles, &c.—A. M. Clark. Material as a substitute for window glass (com).—H. Kenyon and I. Swindells. Manufacture of nitrogen and its application to the production of various articles.—M. Baerlein. Sizing, stiffening, and otherwise preparing yarn for weaving.

On December 6th.—4015 to 4031.—J. Norbury. Valve arrangements of hydraulic presses, &c.—T. Read. Boilers.—W. Mather. Apparatus used for the purpose of percolation or filtration of fluids or infusions, and the precipitation of bodies held in suspension in fluids (com).—J. Sheldon. Stretching the "tips" of felt hats, —E. C. S. Moore, R.E. Supplying fuel for combustion, the coal or other combustible material being supplied underneath the burning coal or other material, whereby economy is effected in its combustion.—F. Page. Moulding of artificial fuel when in a wet or pasty condition.—W. C. Taylor. Safety valves.—G. Hall. Securing knobs to spindles in door furniture—D. Jones. Obtaining and applying motive power. —T. Lockwood and A. Chappell. Looms for weaving.—A. Walker. Hansom cabs.—F. Wirth. Ropes and carriages employed upon tramways (com).—J. H. Johnson. Treatment of wool, silk, and other animal textile materials, whether in a raw or manufactured state.—A. A. Welch. Feeding and watering cattle during railway journeys.—R. Okell. Harness for horses.—J. T. Parlour. Armour for ships, floating batteries, forts, and other structures.—G. Haseltine. Stitching books. (Complete specification).

On December 8th.—4032 to 4047.—R. Smith, W. Stephenson, J. Vere, and B. Capel. Capstans for fishing and other vessels.—M. B. Bouju. Oil.—H. Moore. Roadways or pavements.—M. McSherry. Fireplaces of cooking ranges.—C. J. Galloway and J. H. Beckwith. Steam boilers.—W. Lancaster. Transmitting variable speeds to revolving shafts or axles.—H. Cockey and F. C. Cockey. Gas stoves.—W. H. C. Stanford. Earthenware pipe joints.—W. R. Lake. Drawers for men and boys (com).—J. W. Scott. Stud buttons or lacing studs for boots, shoes, and other garments.—L. Turner. Looms for weaving elastic fabrics.—D. Dawson and C. Slater. Dyeing apparatus.—A. Waithman. Finishing twine.—T. C. Fawcett. Brickmaking machines.—W. Sellers. Lawn mower. (Complete specification).—A. M. Clark. Mills for hulling maize (com).

On December 9th.—4049 to 4060.—W. Walker. Utilisation of peat, and the apparatus therefor, parts of which are peculiarly applicable to the roasting and smelting of powdered sand and other small metallic ores.—E. Barge. Chairs. —F. Young. Apparatus for carrying, raising, and lowering ships' boats.—G. Haseltine. Looms for weaving (com.) (Complete Specification.)—R. F. Thompson. Construction of saws.—W. Wilcox. Trucks or waggons for the conveyance of cattle and other animals by railway, one being also applicable to carriages for the conveyance of invalids, and to railway carriages generally.—W. O. Palmer. Wheels and axles for railway, tramway, or other rolling stock.—J. Harrington. Method of binding together a number of sheets or leaves of paper or other material.—M. Todd. Apparatus for utilising exhaust steam.—J. Cornforth. Machinery for the manufacture of cut nails and tacks.—W. Neill and F. A. R. Neill. Railways and engines or carriages running thereon.—M. Baxter. Seed drills (com.)—L. Dupont. Gas burners.

MRS. SOMERVILLE'S MEMOIRS.

Third Thousand, with Portrait, crown 8vo, 12s.,

PERSONAL RECOLLECTIONS from EARLY LIFE to OLD AGE of MARY SOMERVILLE. With selections from her Correspondence. Edited by her Daughter, MARTHA SOMERVILLE.

"This is a charming book; the story of the life of a remarkable and beautiful character, told for the most part in the tranquil evening of her well-spent days, by herself, with short additions here and there by her daughter, to complete the narrative. Few readers will put this volume aside after, what must always be, a pleasant perusal of its pages, without feeling that it has imparted, by a mysterious sympathy, much of the goodness which is diffused throughout it."—ATHENÆUM.

"Mrs. Somerville was in science what Madame de Stael was in literature; but she had a far more expansive and varying intellectual sympathy than Madame de Stael. She loved painting, and at one time studied and worked at the art with every promise of decided success. She delighted in literature of all kinds, and in music. She was an enthusiastic admirer of everything beautiful in nature as in art, and she maintained from first to last a keen sympathy in the political progress of all countries."—DAILY NEWS.

"Miss Somerville has done her part with excellent tact and judgment. The 'Recollections' are each amusing, picturesque, or instructive; and the letters introduced, whether written by Mrs. Somerville or to her by Herschel, Faraday, Humboldt, Brougham, &c., possess generally some interest apart from the writers' names At the close of the volume we feel that we have had too few rather than too many of the relics of so rich a life. Her daughter, so far as her own share in the book is concerned, has written as little as it was possible to do while conveying the needful facts and stringing her beads into a chain."—QUARTERLY REVIEW.

WORKS BY MRS. SOMERVILLE.

MOLECULAR and MICROSCOPIC SCIENCES. With 180 Illustrations. 2 vols. Post 8vo, 21s.

"With what indefatigable industry and unflagging powers of acquiring knowledge Mrs. Somerville worked is best shown in her carefully compiled work on 'Molecular and Microscopic Science.' It is without a parallel as the intellectual feat of anyone drawing close to the 90th year, and more especially of a woman."—SATURDAY REVIEW.

"A work in which is contained a résumé of the most interesting results of recent scientific investigation."—NATURE.

THE CONNECTION of the PHYSICAL SCIENCES. 9th Edition. Post 8vo, 6s.

"This generally exact and admirable treatise."—HUMBOLDT.

"Mrs. Somerville's 'Connection of the Physical Sciences,' published in 1834, and her 'Physical Geography,' in 1848, was the means of drawing attention to the results obtained through the labours of a host of explorers, voyagers, and scientific thinkers."—SATURDAY REVIEW.

PHYSICAL GEOGRAPHY. 6th Edition. Post 8vo, 9s.

"This work in numerous points comes into close contact with the subject of Humboldt's Kosmos, a formidable competition, but one out of which Mrs. Somerville often comes successfully."—SIR HENRY HOLLAND.

"Mrs. Somerville's 'Physical Geography' is the work she is most generally known by, and notwithstanding the numerous works on the same subject that have since appeared, it still holds its place as a first authority."—NATURE.

JOHN MURRAY, Albemarle-street.

NEW VOLUME. WEALE'S EDUCATIONAL SERIES.

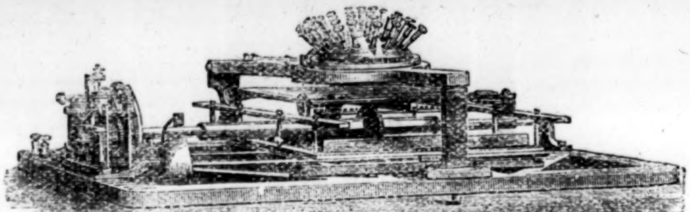
12mo, limp cloth, with numerous illustrations, price 2s.

A COURSE OF ANALYTICAL CHEMISTRY (Qualitative and Quantitative); to which is prefixed a Brief Treatise upon Modern Chemical Nomenclature and Notation.

By WILLIAM W. PINK, Practical Chemist and Metallurgical Analyst; and GEORGE E. WEBSTER, Lecturer on Metallurgy and the Applied Sciences, Nottingham.

London: LOCKWOOD and Co., 5, Stationers' Hall Court.

BY HER MAJESTY'S ROYAL LETTERS PATENT.



THE "WRITING BALL," OR ELECTRIC TYPE-WRITING APPARATUS

Has been highly spoken of by "Telegraphic Journal," the "Engineer," the "Mechanic's Magazine," and several foreign papers; the KING OF DENMARK having shown the Inventor, the Rev. Malling Hansen, his appreciation of the invention by decorating him with the "GOLD MEDAL OF MERIT." The "Writing Ball" obtained A FIRST-CLASS MEDAL at the Copenhagen Exhibition of 1872, and the MEDAL FOR PROGRESS at the Vienna Universal Exhibition of 1873.

It enables the expert to write three or four times as fast as with pen and ink, the blind to write his own letters, him who has lost both arms still to write and do it fast; it allows of 10 copies being taken in one operation; it always writes distinctly and plainly. It is, therefore, of value in the Telegraph Service for copying messages, in large offices for correspondence, for copying shorthand notes, &c., &c.

An inspection is respectfully invited by

SOFUS E. HOLTEN, 82, GRACECHURCH STREET, LONDON, E.C.,

Agent to the Proprietors of the British Patent;

and all particulars may be had of

MR. C. GRAHAM CARTTAR, Public Accountant, 14, CLEMENT'S INN, STRAND, W.C.

TO CAPITALISTS.

THE ATTENTION OF CAPITALISTS IS SOLICITED TO the following Inventions, for carrying out which, the Advertiser desires to obtain pecuniary assistance:—

Improved Metallic Plates for plating the sides and bottoms of Ships and Vessels to prevent fouling and decay of the plates.

Improved Metallic Compositions for the sides and bottomsof Iron Ships and Vessels to protect the iron and prevent fouling.

Improvements in manufacturing Plates to be used for plating the outsides of Iron Ships.

Improvements in Armour Plates for War Ships, and in fixing same.

Improved Swinging Cabin or Cockpit for War or Merchant Ships.

Improved Swinging Cabin or Cockpit for War and Merchant Ships to carry Ordnance Guns, also applicable for floating Light-ships, Mariners' Compasses, or other things required to be kept level.

A Mechanical Machine, being an economical substitute for Hydraulic Horse or limited Steam Power.

Improvements in Balloons or Machines to float in the air, and for propelling and navigating the same.

A Perpetual Self-acting Hydraulic Machine.

A Curb for runaway Horses.

Improved Trap for Drains.

Improved Iron Bridge or Viaduct.

SAMUEL CALLEY, 25, Leighton-grove, Kentish Town, N.W.

IMPORTANT INVENTIONS FOR SALE, DISPOSAL, OR LICENCE.

THE ATTENTION OF CAPITALISTS AND MANUFACTURERS

Is solicited to the following list:—

PATENTS OPEN TO PARTNERSHIPS, SALE, OR LICENSE FOR IMPROVEMENTS IN

Bricks, and Roofing Tiles.
Bottle Stoppers.
Couplings, or Joint, for Hose, Water Pipes &c.
Saucepan Stirrer.
Machine for Making Brushes.
Tin Lined Lead Pipes.
Traps for preventing escape of foul air.
Diaries and Account Books.
Life Boats.
A Covering for Tramway Cars.
Steam Ploughs, anchors for.
Sewage Manure.
Treating Skins and Furs.
Earth Closets and Water Closets.
Boilers for Steam Engines.
Hammock Beds.
Locks.
New Musical Instrument.
Purification of Whiskey and other Spirits.
Application of Petroleum and other Hydro Carbons as Motive Power.
Machine-made Wood Pavement.
Heating and Hot Water Apparatus.
Self Cleansing Water Filters.
Steam Ploughs.
Cultivating Apparatus.
Bottles for Port Wine.
Also several valuable American, French, and other Foreign Patents.

FOR PARTICULARS AND TERMS APPLY TO—

MR. C. GRAHAM CARTTAR, PUBLIC ACCOUNTANT,

14, CLEMENT'S INN, STRAND, W.C.

THE INVENTORS' INSTITUTE,

ESTABLISHED 1st MAY, 1862.

FORTNIGHTLY MEETINGS, DURING SESSION,
HELD AT
4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

Past President—Sir DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the Establishment of the Inventors' Institute till his decease, February, 1868.

Past President—Lord RICHARD GROSVENOR, M.P., &c., from February, 1868, till May, 1871.

Council:

CHAIRMAN OF COUNCIL,
SIR ANTONIO BRADY, Knt., &c.

The Right Hon. The Earl of Caithness, Vice-Pres.
The Hon. Algernon Egerton, M.P., Vice-Pres.
Sir William Fairbairn, Bart., C.E., LL.D., F.R.S., Vice-Pres.
Lord Richard Grosvenor, M.P., Vice-Pres.
Beresford Hope, Esq., M.P., Vice-Pres.
General the Hon. James Lindsay, M.P., Vice-Pres.
His Grace the Duke of Manchester, Vice-Pres.
Robert Richardson, Esq., C.E., Vice-Pres.
Captain Jasper Selwyn, R.N., Vice-Pres.
Henry Brinsley Sheridan, Esq., M.P., Vice-Pres.
Sir W. Worsley, Bart., M.A., Vice-Pres.
Alexander Allan, Esq., C.E.
Dr. George Bachoffner, M.A.
P. W. Barlow, Esq., C.E., F.R.S.
W. H. Barlow, Esq., C.E., F.R.S.
Charles de Bergue, Esq.
Henry Bessemer, Esq.
The Hon. Slingsby Bethell
M.P.W. Boulton, Esq.
Colonel Boxer.
JacobBright Browett, Esq.
Benjamin Burleigh, Esq., C.E.
F. W. Campin, Esq.
Samuel Chatwood, Esq.
D. K. Clarke, Esq., C.E.
Dr. Robert H. Collyer, F.C.S.
Sir Fothergill Cooke.
Samuel Courtauld, Esq.
H. C. Coulthard, Esq., C.E.
Dr. J. M. Croft.
T. B. Daft, Esq., C.E.
Robert Davison, Esq., C.E.
William Dempsey, Esq., C.E.
W. Hempson Denham, Esq., M.D.
. Dircks, Esq.
Thomas Dunn, Esq., C.E.
John Farmer, Esq.
J. Faulding, Esq., C.E.
H.A. Fletcher, Esq., C.E., F.R.A.S.
John Grantham, Esq., C.E.
Hugh Greaves, Esq., C.E.
Robert Griffiths, Esq.
E. Hall, Esq.
M. M. Harris, Esq.
G. W. Hemans, Esq., C.E.
W. T. Henley, Esq.
Alexander Mitchell Innes, Esq.
W. Mitchell Innes, Esq.
Julius Jeffreys, Esq., F.R.S.
Dr. H. C. Jennings.
Dr. P. W. Latham, M.A.
Sampson Lloyd, Esq.
Edward Lord, Esq.
D. J. McLauchlan, Esq.
J. E. McConnell, Esq., C.E.
Walter Macfarlane, Esq.
Colin Mather, Esq.
John Mackintosh, Esq.
W. W. Moore, Esq.
Thomas Morgan, Esq.
George Frederick Muntz, Esq.
A. J. Murray, Esq., C.E.
A. Normandy, Esq.
J. J. Parkes, Esq., C.E.
W. H. Preece, Esq., C.E.
T. W. Rammell, Esq.
John Ramsbotton, Esq., C.E.
Fred. Ransome, Esq., C.E.
J. J. Russell, Esq.
John Saxby, Esq.
A. Sedley, Esq.
C. WilliamsSiemens, Esq., C.E. F.R.S.
E. Sonstadt, Esq.
Berger Spence, Esq.
Cornelius Varley, Esq.
Robert Wheble, Esq.
E. O. W. Whitehouse, Esq., C.E.
Hume Williams, Esq.
W. N. Wilson, Esq.
W. Yates, Esq.

Bankers.
LONDON & WESTMINSTER BANK.

Secretary.
F. W. CAMPIN, Esq.

Auditor.
G. GRAHAM CARTTAR, Esq.

The various efforts which have been made, and the numerous influences now at work to injure, if not destroy, Patent Rights; the inefficiency of the many well-intended, but ill considered, Schemes of Patent Law Reform, which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor without advantage to the Public; together with the proceedings so essentially involving the interests of Inventors which have already taken place in Parliament, as to the propriety of abolishing Patent Rights altogether, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organising the influence of Inventors, Patentees, and others. Its objects are:—

1st. To protect Inventors' interests, and defend the privilege of obtaining Her Majesty's Letters-Patent.
2nd. To promote improvements in the Patent Laws.
3rd. To facilitate the diffusion of information with reference to Inventions, and other subjects beneficial to Inventors and Patentees.

The qualification for Annual Members of the Institute is a Yearly Subscription of One Guinea, and for Life Members a single payment of Ten Guineas

NOTICE TO INTENDING PATENTEES.

THE INVENTORS' PATENTRIGHT ASSOCIATION, LIMITED,

(*The Proprietors of the "Scientific and Literary Review"*),
21, COCKSPUR STREET, CHARING CROSS, LONDON, S.W.,
OBTAIN PATENTS FOR INVENTIONS AT FIXED AND MODERATE CHARGES

DIRECTORS.
P. W. LATHAM, Esq.
F. W. CAMPIN, Esq., Barrister-at-Law.
G. B. FINCH, Esq.
AUDITOR.
RICHARD COCKER, Esq.
BANKERS.
LONDON AND WESTMINSTER BANK, St. James's Square.
SCIENTIFIC REFEREES.

Sir CHARLES FOX, C.E., F.R.G.S., &c.
W. H. BARLOW, Esq., C.E., F.R.S., &c.
Professor WILLIAM POLE, C.E., F.R.S., &c.
JOHN WOODHOUSE, Esq. C.E., and M.E., &c.
ROBERT RICHARDSON, Esq., C.E., &c.
Captain J. H. SELWYN, R.N., &c.
HIRAM CRAVEN COULTHARD, Esq., C.E., &c.
BENJAMIN BURLEIGH, Esq., C.E.
Dr. B. H. PAUL, F.C.S.

BRITISH 12 MR 74 MUSEUM

This Association was established in the year 1867, for the purpose of simplifying, cheapening, and expediting as far as possible the proceedings attending THE OBTAINING OF PATENTS FOR INVENTIONS and their commercial development.

Several leading members of the Inventors' Institute, coming daily in contact with Inventors, whose wants and difficulties were daily pressed on their attention, formed themselves into this Association, entitled "The Inventors' Patentright Association, Limited," in order to supply Inventors with the best and most reliable information and advice—to provide skilled references on questions of science and manufacture—to render legal processes for protecting and maintaining patent rights safe, cheap, and ready—and to aid Inventors in bringing their inventions into practicable and profitable shape. To carry out these views, the following are the

OBJECTS OF THE ASSOCIATION.

To obtain Patents for Inventions in this and other countries.
To Register Designs.
To form Public Companies, or otherwise arrange for the Public Introduction of Patented Inventions.
To Sell, and License Patented Inventions.
To furnish advice and professional Assistance in developing Inventions.
To collect Evidence, arrange Arbitrations, and otherwise assist Inventors in maintaining their rights.

N.B.—To Members of the Inventors' Institute this Association offers special privileges in the obtaining of Patents, both in this country and in all parts of the world.

A Handbook furnished gratis on application to THOMAS MORGAN, Secretary, 21, Cockspur Street, Charing Cross, London.

London: Printed by H. W. Foster, 16, Bear Alley, Farringdon Street, E.C.; and Published for the Proprietors at 21, Cockspur Street, Charing Cross; and Sold by W. Kent & Co., 23, Paternoster Row, and Sampson Low, Son, & Marston, English, American, and Colonial Booksellers and Publishers, Crown Buildings, 188, Fleet Street, London, E.C.